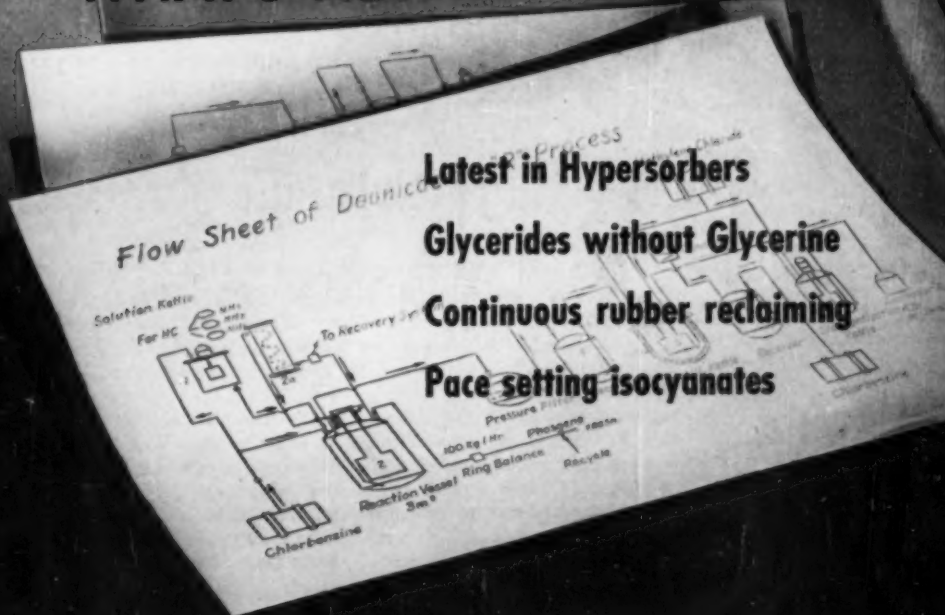


JULY
1951

Chemical Engineering

WHAT'S NEW



NEW PROCESS AND PRODUCTION TECHNIQUE NEWS BEGINS THIS MONTH ON **PAGE 183**



Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Make piping permanent and leakproof



Write Dept. H-7 for free booklet listing properties of pipe and welding fitting and flange materials.

PIPING PERMANENCE is always important but now, more than ever, any installation of piping should be leakproof, maintenance-free and have extra long life. A piping system, big or small, is only as strong as its weakest component. That's why welding fittings, for example, should be specified with care.

TUBE-TURN Welding Tees are drawn from seamless tubing to a barrel shape—the shape every tee wants to assume under pressure. This feature, together with the generous crotch radius and thickness, explains why TUBE-TURN Welding Tees withstand more pressure without yielding. Bursting pressures obtained in tests of representative fittings have averaged more than 25% higher than required by standard codes. Here's extra quality at no extra cost.

Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

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JULY
1951

Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

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July 1951

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Member ABC and ABP

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HEAT EXCHANGER MAINTENANCE

CAUTION

IS NOW

A

MUST!

CORROSION



Eating away the metal of tubes and shells. Chemical neutralization can be used in some cases. Selection of proper tube and shell metals beforehand is best way to combat corrosion.

SCALE FORMATION



The deposit of solids on the inside and outside of tubes . . . very poor heat conductors. Cutters, vibrators, sand blasting will keep scale formation down.

GUM ACCUMULATION



Gum is a bad heat conductor too. Get rid of it by the proper chemical cleaning and brushing.

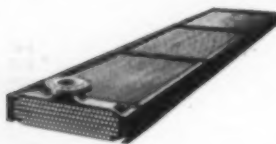
The extreme 24 hour service load in refining, and processing together with the high temperatures, high pressures, and fluids handled, create maintenance problems on heat transfer equipment which make it difficult to wring out that last ounce of service so vitally needed today.

When corrosion, scale formation and gum accumulation take charge of your heat transfer equipment they (1) Reduce efficiency because of the insulating properties of the scale; (2) Cost valuable time through overly extended cleaning periods; (3) Increase maintenance expenses in cleaning equipment and man hours; (4) Step up the depreciation of your equipment.

With an eye on the future, we at Western are encouraging old and new customers alike to look carefully at their operational and maintenance records. We are, right now, hitting hard on the idea of replacement, for in many cases heat exchangers now in operation have already passed the point of economical and efficient service. We serve the petroleum, chemical processing, refining, and pipeline industries and will be glad to consult with YOU on YOUR heat exchanger needs.

Look to Western for all your requirements in Shell-and-Tube Exchangers, Atmospheric Sections, Floating Head Exchangers, and Reboilers. More detailed information on our facilities will be forwarded upon request.

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FOR YOUR
CONVENIENCE



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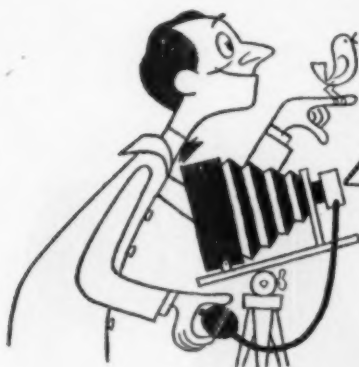
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Manufactured by
WESTERN SUPPLY COMPANY
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SALES OFFICES - DALLAS - HOUSTON

do these
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fit into YOUR
product picture?



*How you can
use them . . .*

ETHYL AMINE*

- as a volatile alkali in process industries.
- as an intermediate for making: emulsifiers, plasticizers, dyestuffs
- as a deflocculating agent in manufacture of ceramics.

DIETHYL AMINE

- as an intermediate for making: rubber accelerators, insecticides, pharmaceuticals, dyestuffs
- its sulfamic acid salt is an effective flame-retardant plasticizer for paper.

TRIETHYL AMINE

- as an inhibitor for chlorinated solvents.
- as an anti-living agent in urea- and melamine-based enamels.
- for solubilizing 2,4-D, a selective herbicide. Only 101 lb. of Triethyl Amine needed to neutralize 221 lb. of 2,4-D.

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OTHER ALKYL AMINES

When you are considering alkyl amines, keep in mind that CARBIDE also supplies n-Butyl, Di-n-Butyl, Isopropyl, Diisopropyl, 2-Ethylhexyl, and Di (2-Ethylhexyl) amines. Samples and technical data are available to help you evaluate them.

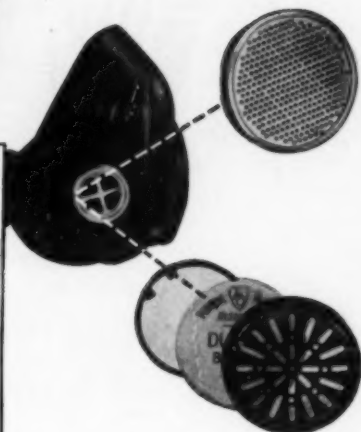
*Commercial grade is a 70% aqueous solution.



NEW AO RESPIRATOR LINE

Pay for ONE Facepiece, GET 7 TYPES OF PROTECTION with the AO R5000!

Yes, due to quick interchangeability of its threaded cartridges and disc type filter, the AO R5000 line of TWIN CARTRIDGE RESPIRATORS permits you to standardize on one respirator in protecting your workers against the multitude of dust, vapor and gas hazards commonly met with in industry. Remember, there's only one facepiece to stock and the R5000 offers greater visual area and many advanced construction features that mean added safety and comfort. Ask your nearest AO Safety Products Representative for the R5000. Tell him the respiratory hazards encountered in your operations and he will recommend the disc type filter and/or cartridges required.



QUICK, EASY INTERCHANGING!

Retainer assembly accommodates both chemical cartridges and AO disc type filter — the small chemically treated filter that gives 40 times the dust protection of untreated filters. The cartridges screw in — assures a positive gas-tight seal. The felt filters stay put safely by a cover that screws onto retainer assembly.

American Optical

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Dust Filter and Organic Vapor Cartridges,
Combinations of both, and Metal Flame
Cartridges Approved by the U. S.
Bureau of Mines

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Gunthard BUILDS HOMOGENEOUS LEAD-LINED EQUIPMENT.....



TO YOUR
Specifications

This 8' x 30' homogeneous lead-lined pressure vessel has recently been installed in one of the world's largest petroleum refineries.

Gunthard equipment and know-how was specified here to eliminate breakdowns and thus reduce costly shutdown time to a minimum.

The results show

SAVINGS IN MAN HOURS

SAVINGS IN OVERALL OPERATING COSTS in excess of the original cost of the vessel.

The Gunthard organization has every facility for fabricating homogeneous lead-lined equipment—

from 2 inch carbon steel fittings and all sizes of tanks and vessels, up to massive 90 foot towers. Skilled personnel fabricate equipment of every type from ferrous and non-ferrous metals including aluminum, stainless, stainless-clad and carbon steels.

We number among our regular customers many of the largest and most progressive chemical processing companies in the nation. If you have a problem that might be solved by expert metal fabrication—with or without lead lining or covering—write for complete information on how Gunthard engineering services and facilities can be of provable cost-cutting value to you.

A. GUNTARD COMPANY ENNIS, TEXAS



These well known troublemakers have nothing to do, as far as valve performance is concerned in plants that have installed the CASH STANDARD "1000". So to keep them idle in your plant get this STREAMLINED VALVE on the job.

The Straight Line Flow eliminates turbulence, giving highest valve capacity. From inlet to outlet the fluid flows through this valve in a straight line—a streamline—almost as though there were a pipe, running through the valve housing for the fluid to flow through. There is no detour around a dividing wall—the direction of flow is not changed at right angles because of a seat wall—also, the flow is not broken up by valve stems, springs, or other parts.

CASH STANDARD
Streamlined
PRESSURE
REDUCING VALVE
TYPE 1000

CHECK ALL THESE BENEFITS FOR THEY CAN ALL BE YOURS

- Maximum capacity when needed most.
- Accurate pressure control under toughest working conditions.
- Trouble-free service.
- Smooth operation.
- Tight closure.
- Speedier production results.
- Elimination of failures.
- Cost-saving operation.
- No spoilage.
- Practically zero in maintenance.

Get the highest returns from your valve dollars.

It is being done in plants across the country. As an example of what users think read what the plant engineer of a Glass Corporation has to say—"The STREAMLINED Valves we are using are the best reducing valves I have ever seen. I have them on my oil lines to our 2-200 H.P. each Water Tube Boilers holding a constant pressure which gives us good firing conditions.

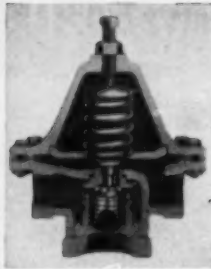
Send FOR BULLETIN 962

Also on our glass machines and air conditioning unit. Wouldn't change for anything."

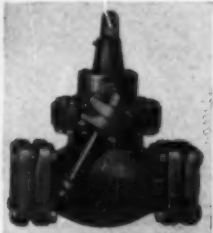
CASH STANDARD
CONTROLS..
VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

**BULLETINS
AVAILABLE
ON OTHER
CASH STANDARD
VALVES**
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

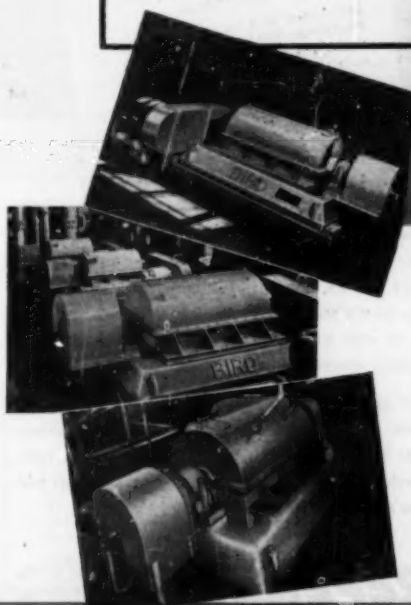
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Ammonium Alum
Ammonium Chloride
Ammonium Nitrate
Ammonium Sulphate
Aniline Sludge
Barium Carbonate
Barium Chloride
Barium Sulphate
Beryllium Sulphate
Black Ash
Borax
Calcium Carbonate
Carnallite
Chromium Oxide

Coal, bituminous &
anthracite
Copper Sulphate
Copperas
Cryolite
Di-Sodium Phosphate
Ethyl Cellulose
Fish Meal
Flotation Concentrates
Flotation Tails
Foundry Sands
Gland Extracts
Glaubers Salt
Glutamic Acid
Hexachlorethane
Hexamine
Iron Ore

Iron Oxide
Langbeinite
Lead Arsenate
Lead Chromate
Lime
Lime Mud
Lithopone
Manganese Ore
Nickel Salts
Packing House Waste
Phenol
Phosphate
(High Grade Residue)
Potassium Carbonate
Potassium Chloride
Potassium Hydroxide
Potassium Nitrate
Potassium Sulphate
Potato Starch
Sodium Bichromate
Sodium Carbonate
Sodium Chloride

Sodium Fluoride
Sodium Hydroxide
Sodium Nitrate
Sodium Stannate
Sodium Sulphate
Sodium Sulphite
Sodium Thiosulphate
Solvent Extractions
Starches
Sulfur
Synthetic Resins
Tallow
Tartaric Acid
Tin Ore
Titanium Dioxide
Tri-Sodium Phosphate
Tungsten Salts
Ultramarine Pigment
White Lead
Zinc Chromate
Zinc Oxide
Zinc Sulphide



Calls for BIRD CENTRIFUGAL FILTERS

Specific information on filtering efficiency, production and cost per ton is either already available or readily obtainable from pilot scale test runs of your filter feeds at the Bird Research and Development Center.

BIRD MACHINE COMPANY

SOUTH WALPOLE • MASSACHUSETTS

"Even the UNUSUAL can include the CONVENTIONAL"—REVERE



ATMOSPHERIC TOWER OVERHEAD CONDENSERS

Each battery of 6 has a total capacity of 60,000,000 BTU/hr with 18,000 square feet of effective surface. Made by Henry Vogt Machine Co., Louisville, Ky.
Revere Naval Brass fixed and plates are 38 1/2 in. diameter by 2 1/2 in. thick, floating and plates are 35 3/4 in. diameter by 2 in.

These Henry Vogt Machine Co. condensers have an unusual feature: vapor belts in the shells to feed more copious and uniform flows of vapor than are obtained by the usual single nozzles.

Inside the condensers, the tubes are rolled into Revere Naval Brass Tube Sheets.

The use of Revere Naval Brass for this purpose is completely conventional in condenser building practice. Revere Naval Brass is corrosion resistant, strong, tough, durable. Every mechanic on the production line knows how to fabricate it. Every maintenance man knows how to treat it when doing a servicing job. Thousands of Revere Naval Brass plates are in daily use in condensers and other heat exchangers built by all the best manufacturers. Some of these plates have been in service for decades.

Revere has alloys for your unusual design features too. Some of these are conventional, made to do unusual jobs because the Revere Technical Advisory Service knows where and when to recommend them. Others are less well known.

When you work out an unusual design you want to concentrate your attention on the unusual features. Under those conditions, use the time tested, service proven, utterly dependable standard Revere alloys in the standard parts of your design and you will be able to forget those parts and keep your attention where it is needed.

For any problem at all that involves the use of metals, consult the Revere Technical Advisors. Their knowledge, skill, experience, contacts (yes, we ask questions as well as answer them) can add up to money in the bank for you.

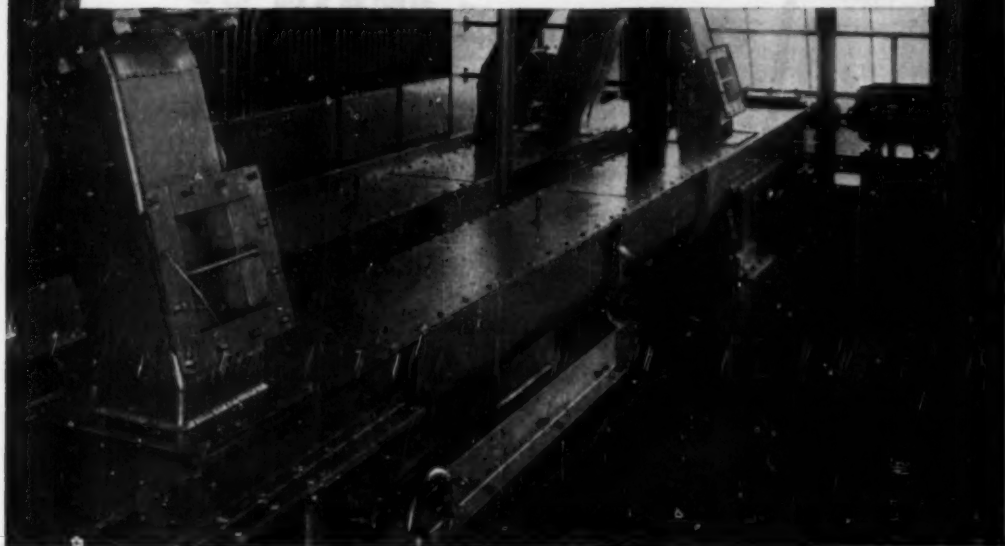
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COPPER AND BRASS INCORPORATED

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Screw Conveyors, too, require research-engineering



Link-Belt screw conveyors have a multitude of applications in handling bulk materials. Here pulverized fuel is fed to boilers. Entire system is dust-tight.



Helioid or Sectional Conveyor Screws — for general screw conveyor applications; may also be furnished in the metal and finish best suited to your purpose and with components selected from the most complete line.

LINK-BELT

SCREW CONVEYORS

CHEMICAL ENGINEERING—July 1951

We want to sell Screw Conveyors. But more important, we want you to get the most out of them!

As THE leading producer of conveying and elevating equipment, Link-Belt has developed many screw conveyors for specialized applications. That's why we offer you the widest range of types . . . in any suitable metal to meet requirements like high temperature, corrosion, sanitation, abrasion . . . in a full range of diameters, gauges, pitches.

Link-Belt Screw Conveyors are simple and compact . . . have few wearing parts. More . . . they are accurately made to insure easy assembly, smooth and continuous operation.

And here's another plus — Link-Belt can supply all of the components such as conveyor screws, collars, couplings, hangers, troughs, trough ends, flanges, thrusts, drives. Call your nearest Link-Belt office for complete information.

LINK-BELT COMPANY: Chicago 8, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 3, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities.

12.50

NEVILLE

LX-767

SHINGLE STAIN OIL

is a new improved shingle stain oil which will give you a better pigmented or non-pigmented oil at less cost, because it has a mild odor, good penetration and is uniform. In addition, because of its light color you can easily formulate colored oils economically. Such properly pigmented oils will show no rub-off.

Readily available at 15¢ gallon in tank-cars and 25¢ gallon non-returnable drums F.O.B. Neville Island, Pa.

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**LIGHT
COLOR**

★
**LOW
COST**

★
**MILD
ODOR**

A-38

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PITTSBURGH 25, PA.

Plants at Neville Island, Pa. and Los Angeles, Calif.

RESINS COUMARONE-INDENE • MODIFIED COUMARONE-INDENE • PETROLEUM • ALKYLATED PHENOLS
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SPECIALTIES PHENOTHIAZINE • RUBBER COMPOUNDING MATERIALS • TAR PAINTS

Only with B. F. Goodrich grommet belts can you make these savings!

*Save 3 ways! Investigate today!
Write or mail coupon*

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention.

Patented grommet belts by B. F. Goodrich represent the only basic change since invention of the V belt. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service, the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

What is a grommet?

A grommet is like a giant cable except that it's *endless*—a cord loop built up by winding heavy cord on itself. There is no overlapping cord section as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

Each of the two grommets and every part of a grommet carry their share of

the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume—and less stretch. Grommet belts stretch, on an average, only about one-third as much as ordinary belts.

Better grip, less slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give $\frac{1}{2}$ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

Send for proof

Send the coupon for a set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others. Some typical cases:

"... within a few days ordinary belts had stretched ... After six months of 24-hour-a-day service BFG grommet belts haven't stretched at all ..."

"Ordinary belts lasted only 5 or 6 weeks ... B. F. Goodrich grommet belts are in their sixth month of service ..."

"Previous belts suffered from shock loads, wore out fast ... BFG grommet belts have been in service 2 years with no shut-downs ..."

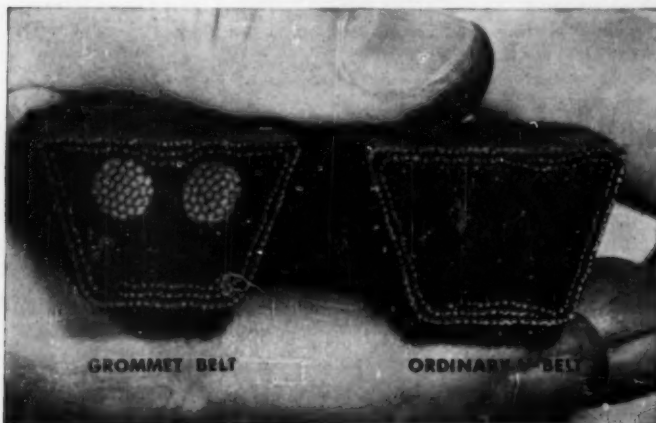
There are hundreds of cases like these.

They cost no more

BFG grommet belts cost not one cent more than others. The savings they make for you are clear profit. They are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

Write, send the coupon or see your B. F. Goodrich distributor. (He will show you his "X-ray" belt that shows the grommet construction clearly.)

Grommet V Belts BY
B.F. Goodrich
FIRST IN RUBBER



The B. F. Goodrich Company
Dept. CE-7
Akron, Ohio

- ☐ Send set of reports telling users' experiences and showing actual installations proving that B. F. Goodrich grommet belts outlast all others.
- ☐ Have distributor show me the "X-ray" belt that shows how B. F. Goodrich grommet belts are made.

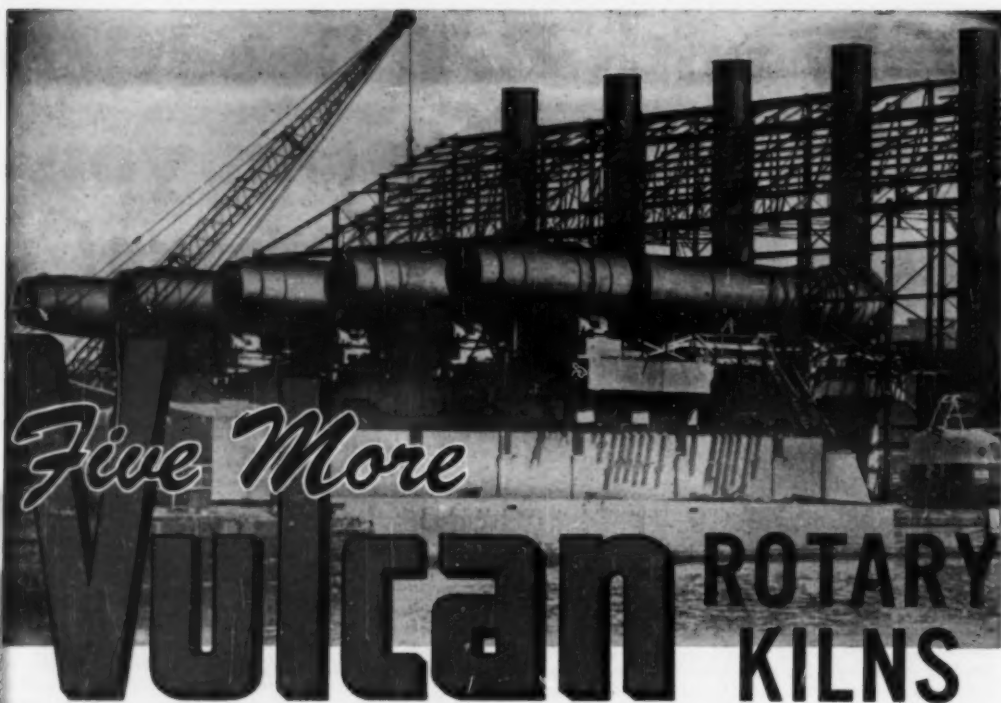
Name _____

Firm Name _____

Street Address _____

City _____

State _____



Five More **Vulcan** ROTARY KILNS

To Help Produce an Essential Chemical Material

The recent installation of Vulcan Rotary Kilns shown above is only one of many now being applied successfully to the calcining, nodulizing, desulphurizing or dehydrating of various types of ores and other inorganic materials. Either an oxidizing or a reducing atmosphere can be applied to the materials being processed or, if desired, they can be kept entirely free from the products of combustion.

For more than half a century the Vulcan Iron Works has been a leader in the design and manufacture of Rotary Kilns, Coolers, Dryers, Retorts, etc. Throughout all of this long period we have maintained the highest standards of quality—the best evidence of which is found in our list of users; which includes most of the larger companies in the Rock Products, Chemical Processing and Metallurgical industries.

Correspondence is invited regarding any requirement for the calcining, cooling or drying of any inorganic material. Our experienced engineers welcome opportunities to make suggestions without charge or obligation.

THIS BOOKLET MAY SAVE YOU MANY HOURS OF PRECIOUS WORKING TIME

It tells how to keep kilns running when trouble occurs—either permanently or until replacement parts can be secured. Better still, it tells how to PREVENT TROUBLE through proper precautions during installation and by watching out for conditions which may cause trouble if not corrected in time. Free on request to any one who can use it to advantage. Ask for Bulletin No. 389.



Vulcan Iron Works

Established 1849 **WILKES-BARRE, PA., U.S.A.** Cable Address "Vulworks Wilkes-Barre"

Other Vulcan Products include Briquetting Machinery, Electric Hoists, Mining Machinery, Open Hearth Steel Castings, Heavy Special Machinery and all types of Modern Industrial Locomotives. Bulletins on request.

Success Stories from ALOYCO's Corrosion Clinic

THE CORROSIVE: Chemicals and solvents used in manufacture of synthetic androgen

THE PLACE: Ciba Pharmaceutical Products, Inc., Summit, N. J.

THE VALVE: ALOYCO gate valves, 100% stainless steel, machined with super-smooth seating surfaces, designed for quick disassembly for inspection and cleaning

THE RESULTS: ALOYCO valves installed in 1946 are still on the job—an astounding record!—with "maintenance practically nil"



Specialized techniques have been developed for the particular problems involved in casting and machining high alloy steels.

THE BACKGROUND: In the broad field of valve applications, ALOYCO concentrates in providing longer valve life when handling corrosive fluids . . . preventing product contamination and discoloration . . . and insuring protection at high or low temperatures.

We work in corrosion-resistant alloys exclusively. All our facilities are directed toward lengthening valve life in corrosion services. Result: *more* ALOYCO corrosion-resistant valves are used than any other brand.

Our Aloyco Corrosion Clinic offers you a specialized laboratory service for "diagnosing" and "treating" cases of too-frequent valve deterioration or product contamination due to valve corrosion.

For reduced valve costs and maximum protection of product purity, put your problem before the Aloyco Corrosion Clinic.

ALLOY STEEL PRODUCTS CO., INC.
1301 West Elizabeth Avenue, Linden, N. J.

Longer
Lasting
Corrosive
Service

Series 600
Gear Operated
Gate Valve
with By Pass

The extraordinary service life of this ALOYCO gear-operated high-pressure gate valve . . . operating under severe corrosive conditions . . . is the result of a unique manufacturing service which includes:

- A. Metallurgical research devoted *exclusively* to corrosive applications
- B. foundry and machine shop facilities set up for high alloy valves only
- C. casting and machining practices dictated by the difficult characteristics of the alloys required for corrosive services.

Longer Lasting
ALLOYCO VALVES
1st in Corrosive Service

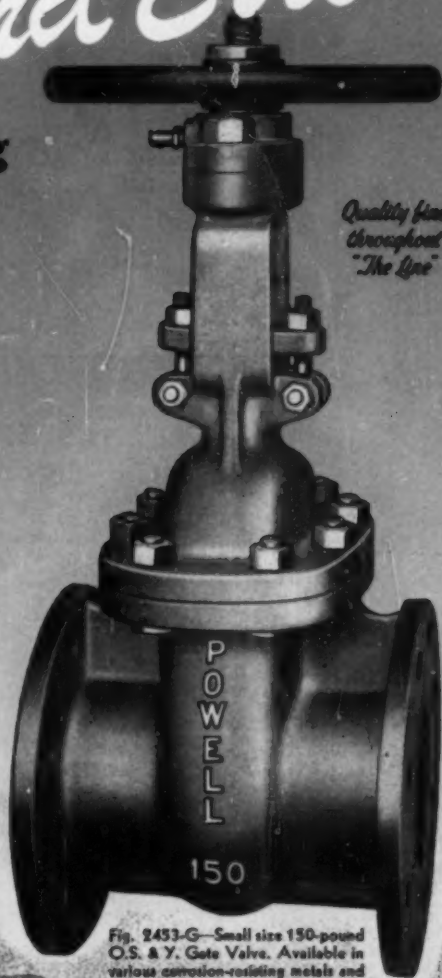
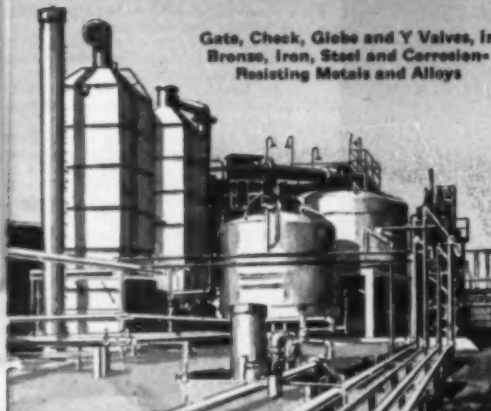
NO ROOM FOR "Trial and Error"

when you're buying
VALVES

You're right the first
time when you install
Powell Valves

Powell makes valves precisely
engineered to suit each and every
industrial flow control service.
Powell Engineers will be glad to
help you select the right valves
to meet your requirements.

Gate, Check, Globe and Y Valves, in
Bronze, Iron, Steel and Corrosion-
Resisting Metals and Alloys



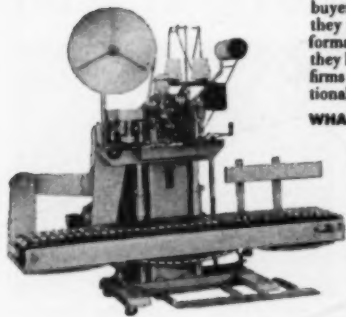
*Quality fine
throughout
"The Line"*

Fig. 2453-G—Small size 150-pound
O.S. & Y. Gate Valve. Available in
various corrosion-resisting metals and
alloys, with stainless steel bolts and
nuts. Conforms to all latest standards.
Also available with screwed ends.

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

YOU'LL KNOW THE
Bagpaker®
BY THE COMPANIES
IT KEEPS



These companies are repeat buyers of Bagpakers. Because they were pleased with the performance of the first Bagpakers they bought, every one of these firms bought one or more additional Bagpakers!

WHAT IS THE SECRET?

First, superior design and construction provide efficient, economical and trouble-free operation. Second, BAGPAK SERVICE assures continued operating efficiency.

That's why Bagpakers pay for themselves in a hurry—and then keep right on paying bonuses

in the form of better, more economical operation.

If you are considering the purchase of a new bag closing machine, then be sure to investigate the Bagpakers. Write today—ask for booklet No. 270-E



International Paper Company

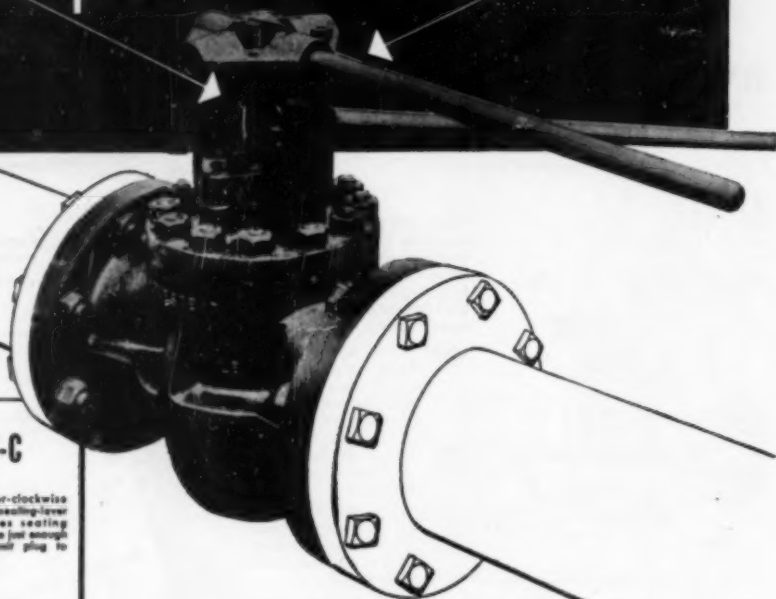


220 East 42nd St., New York 17

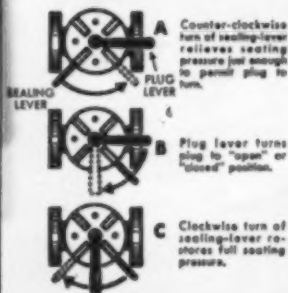
BRANCH OFFICES: Atlanta • Baltimore • Baxter Springs, Kansas • Boston • Chicago • Cleveland • Denver • Los Angeles • New Orleans • Philadelphia • Pittsburgh • St. Louis • San Francisco
 IN CANADA: The Continental Paper Products, Ltd., Montreal, Ottawa.

- at all times
- under all conditions
- throughout its long lifetime of service

This Homestead Valve will always work
 it's **stickproof** because it's **lever-seald**



Simple as A-B-C



Homestead Lever-Seald Valves operate faster, too—16 to 28 times faster than screw-stem type valves. They require no lubrication . . . provide unobstructed, straight-line fluid flow with minimum pressure drop . . . afford maximum protection to sealing surfaces against corrosive and erosive line fluids. And because only a quarter-turn is needed for full opening or closing, they are ideal for installation in restricted areas where operation of other types of valves might be difficult.

Next time you have damaged or sticking valves, replace them with Homestead Lever-Seald Plug Valves. Once you use them you'll never be satisfied with ordinary valves.

For complete information write for Valve Reference Book No. 39-3.

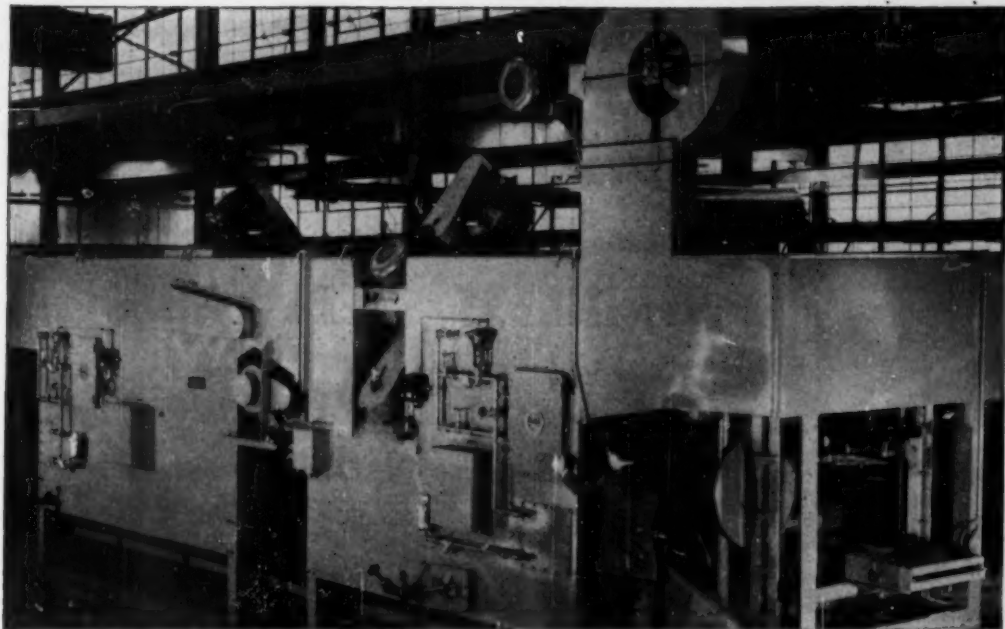
HOMESTEAD LEVER-SEALD PLUG VALVES

HOMESTEAD VALVE MANUFACTURING COMPANY

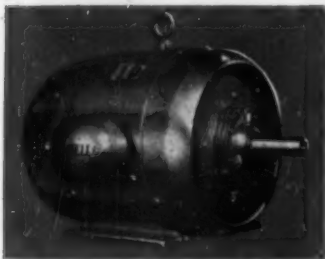
Serving since 1892

P.O. BOX 13

CORAOPOLIS, PA.



How to give a cylinder block a clean start



Howell Type K Motor. Offers constant performance in the presence of dirt, dust, fumes and moisture. Sizes 3 to 150 H.P. at 1800 R.P.M. Either vertical or horizontal mounting.



Howell Type F Motor. A high-slip, high-torque motor designed for punching and shearing operations. Sizes $\frac{1}{2}$ to 200 H.P. in open frames; $\frac{1}{2}$ to 125 H.P. in enclosed frames.

This new Centri-Spray washer thoroughly cleans up to 400 cylinder blocks an hour. It often runs 3 shifts a day, six days a week. A tough job for the nine Howell Industrial Motors which power it!

Four 25-H.P. motors operate the unique Centri-Spray units which envelop the rotating blocks with a powerful high-volume spray of water. A high-head centrifugal pump, equipped with a 15-H.P. motor, flushes blocks internally. All foreign matter is *completely removed*, inside and out. Four motors, from $\frac{1}{3}$ to 20 H.P., power the automatic sludge remover, the recirculating pump, the main conveyor and the high-pressure blowoff fan.

Howell engineers worked closely with this manufacturer to provide the *right* motor for each application. As a result, this Howell-powered washer easily takes the hardest operating schedule in stride.

Highest quality motors, designed for your specific jobs, are typical of the service you get from Howell. Let us handle your electric motor needs. You'll find precision-built Howell industrial type motors a profitable investment that pays off in extra years of dependable performance.

HOWELL ELECTRIC MOTORS COMPANY

Howell, Michigan



HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built industrial motors since 1913

GLOBE



**Specialization Gives You Uniform High Quality In
STAINLESS STEEL TUBES**

GLOBE Seamless

GLOWELD Welded

- Ease of Fabrication
- Resistance to Corrosion and Oxidation
- Strength at High Temperatures



Globe engineers gladly give you the benefit of specialized knowledge of stainless steel tubing in a wide range of services and applications — to improve your product — in cut costs.

GLOBE produces 26 standard analyses of stainless steel tubes —also special analyses when required.

Globe seamless stainless steel tubing may be had in sizes from $\frac{1}{8}$ inch to 6 $\frac{1}{2}$ inches O. D., and in pipe sizes $\frac{1}{8}$ inch to 6 inches, standard, extra strong and double extra strong weights.

Gloweld electric welded stainless steel tubing may be had in sizes ranging from $\frac{1}{8}$ inch to 5 inches O. D. inclusive; in standard weight pipe (schedule 40) sizes $\frac{1}{8}$ inch to 2 inches — lightweight pipe (schedule 5 and 10) $\frac{1}{8}$ to 4 $\frac{1}{2}$ inches inclusive.

Globe Steel Tubes Co., Milwaukee 46, Wisconsin
Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis
Houston • Denver • San Francisco • Glendale, Cal.

TYPICAL ANALYSES

301, 302, 302B, 304, 308, 309,
309S, 309Cb, 310, 314, 316,
316Cb, 317, 321, 329, 330, 347,
403, 405, 410, 416, 430, 443, 446
Inconel* Nichrome**

* Registered U. S. Trade-Mark.

** Trade-Mark Reg. U. S. Pat. Off.-D-H Co.



Write for bulletin 353 — Corrosion and Heat Resisting Steel Analyses Chart — a valuable reference tabulation of stainless steel analyses as produced by various manufacturers.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — seamless steel tubes — Globecron seamless high purity ingot iron tubes — Globe Welding Fittings.

...if

Oxidation Is One Step In Your Process

Investigate! Most dependable

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ZONE

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Your present process requires an oxidant, the potentialities of Welsbach Ozone in increasing your profits through lowering costs make it wise for you to check its possibilities... now!

On the basis of cost, of convenience, of rate of reaction, of yield or of freedom from extraneous substances, Welsbach Ozone is the outstanding chemical oxidant.

It will pay you to look into the use of Welsbach Ozone—not on the basis of cost alone but with consideration of these other advantages too:

WELSBACH
ZONE is

- Economical...
 - Efficient...
 - Dependable...
- an outstanding oxidant!

No storage problem; no procurement problem; no materials handling.

Fully automatic. No complicated control problems. Generated at point of use with equipment requiring little space.

No full-time supervision or labor required.

Constant, predictable operating cost.

Write for information.

THE WELSBACH CORPORATION
ZONE PROCESSES DIVISION
1500 WALNUT STREET, PHILADELPHIA 2, PA.

Pioneers in Continuing Ozone Research



THERMAL ELECTRIC STANDARD SYSTEMS

automatic intermittent
bunker fuel transport

Simplify Your Oil Burner Layouts with this Modern Pipe Heating System!

"Simplicity of Thermal Electric design eliminates all of the headaches that go with the obsolete gadgetry of steam pipe heating.

"The pipelines are clean. Cumber-some steam heating has been junked in favor of passing low-voltage current through the pipeline itself. The heat generated makes even the crudest fuel flow like light oil.

"The fantastic jungle of pipes involved in recirculation has been scrapped. No need for them now since heat source is independent of boilers and burners.

"The ingenious Thermal Electric Tank Unit makes *unbeated* storage practical. It eliminates steam coils in the fuel with their hazards of condensation, and leakage of oil into steam lines.

"On top of all this, Thermal Electric *guarantees* 100% automatic, trouble-free operation!

"What more could any engineer ask? Simplify your next bunker oil layout by specifying a Thermal Electric *Standard System!*"

HOW IT WORKS

Transforming Energizer (A) passes safe 20-volt current through the same pipe that carries the fuel (B). Oil is kept heated evenly at 120° F. over entire system. Thermostat (C) controls heat, makes system 100% automatic.

During intermittent shut-downs, fuel temperature is maintained automatically. During seasonal shut-downs, fuel can solidify—Thermal Electric will melt out the pipe system.

PAT. NO. 2,324,402
Thermal Electric

Fluid Systems Inc., 1881 Dixwell Ave., New Haven 14, Conn.

Please send me "The Common Sense of Heavy Fuel Transport" plus Customer List of hundreds of satisfied users.

Name _____ Position _____

Firm _____

Address _____

City _____ State _____

**THERMAL ELECTRIC
INDUSTRIAL SYSTEMS**

**for pipe transport
of industrial fluids**



Move Any Industrial Fluid Any Distance, at Any Temperature!

"Free yourself from the limitations of old-fashioned pipe heating methods with Thermal Electric Systems!"

"With this all-electric transport system, it no longer matters how hot you must keep the fluid, how far you must move it, nor how exact your temperature control must be.

"Even the most acutely temperature-sensitive fluids are safely handled. Passing low-voltage current through the pipe that carries the fluid spreads even, low-density heat over the entire system, eliminating hotspots. Thermostatic controls won't let temperature vary more than 2°F.

"Different ambient temperatures are no longer a problem, as fluid temperature will not vary. Systems in tandem will bring fluid from cold exteriors to hot indoors with no temperature change.

"If you have a tough heating problem with any fluid, take a good hard look at versatile Thermal Electric Industrial Systems for viscous fluid transport!"

Fluid Systems Inc. are specialty engineers in the handling of industrial viscous fluids. We are available as special aides to consulting or staff engineers in designing transport systems for any fluid.

YEARS OF PERFORMANCE

American Can Company
Paraffin: 6,889° at 160°F.
Kendall Inc.
Resin: 1,315° at 400°F.
Minnesota Mining & Mfg. Co.
Phenol: 225° at 120°F.
Owens-Corning Fiberglass Corp.
Asphalt: 3,535° at 160°F.
Paper Cellulose Kohler
Swiss Chocolate Company
Chocolate: 1,207° at 100°F.
The Wm. J. Wrigley Jr. Co.
Gum: 795° at 100°F.

PAT. NO. 2,324,402
Thermal Electric

Fluid Systems Inc., 1881 Dixwell Ave., New Haven 14, Conn.

Please send me "Simplified Industrial Fluid Transport Cuts Costs" plus customer list.

Name _____ Position _____

Firm _____

Address _____

City _____ State _____

O. G. KELLEY & CO.

Keeps in step with all emergencies

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ATOMIC
AIR FORCE
CHEMICAL
ORDNANCE

Kelley "know how"

builds equipment that serves the world

BIKINI — OAK RIDGE — BROOK HAVEN — HANFORD WORKS

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ENGINEERS DESIGNERS FABRICATORS

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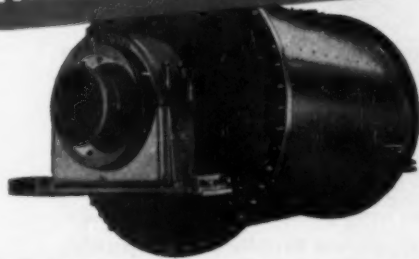
JOHNSON CITY, TENN.

HOUSTON, TEXAS

ELIZABETH, N.J.

Engineered for Grinding Mills

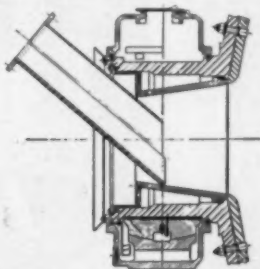
ALLIS-CHALMERS TRUNNION BEARING



EXTRA LARGE — Diameter of king-size Allis-Chalmers trunnion bearing is almost twice the bearing length, large enough to permit spout feeding. Large bearing proportions will provide long service despite heavy-going demands on mill. Internal oil system can be checked visually by means of hinged flap on bearing housing.



LOW BEARING PRESSURE — A spherical seat keeps mill in perfect alignment with bearings. Load is distributed evenly across full face of bearing, reducing wear. Cooling coils embedded in babbitted bearing cool the oil at point where most heat is generated. Piston ring seals hold oil in and dirt out . . . oil supply is always clean.



LONG BEARING LIFE — Internal oiling buckets carry lubricant to oiling pan. Oil is supplied the instant mill is started. All large bearings are fitted with lubricant pump for floating the mill during starting. This overcomes high starting torques and eliminates "dry" starting after shut-downs, which causes about 75 percent of bearing wear.



During normal operation, a film of lubricant separates trunnion from bearing. No metal to metal contact.



After a short shut-down period the thickness of this protecting film of lubricant is reduced.



After long shut-down, lubricant film is broken entirely. The result is damaging metal to metal contact between trunnion and bearing.



Lubricant pump floats the mill before starting . . . re-establishes protecting film of oil. Power needed for starting is greatly reduced, too.

Additional facts about trunnion bearings and other modern features of Allis-Chalmers grinding mills may be obtained without obligation from the A-C representative in your area or by writing to: Allis-Chalmers, Milwaukee 1, Wisconsin.

Taxrope is an Allis-Chalmers trademark.

A-3348

Trunnion bearings are built by Allis-Chalmers in 10 sizes from 14 x 8 to 54 x 22-in. The six smallest sizes are available as grease lubricated bearings; seven largest sizes as oil lubricated bearings.

ALLIS-CHALMERS

Sales Offices in
Principal Cities in
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Throughout the World.



Motors



Controls



Taxrope Drives



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Kilns, Coolers, Dryers



WHY STANDARD DP TURBINE DRIVES FIT ALMOST ANY APPLICATION

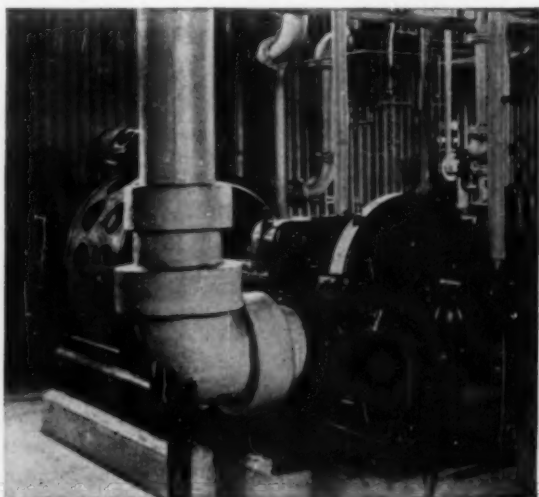
Here's a turbine designed by turbine users. It incorporates the features asked for by hundreds of operators interviewed in an exhaustive survey. They told General Electric they wanted a mechanical-drive turbine that would fit many types of applications—continuous process, standby, indoor, outdoor, equipment drive, generator drive, etc.

The DP answers these varied requirements with special features that are included as standard parts. For instance, you get hydraulic governing to meet critical accuracy requirements, totally enclosed construction that allows installation in hazardous atmospheres, pressure lubrication for dependable, continuous operation. These advantages are included at no extra cost—the DP is priced as a standard.

If you have steam available, the DP turbine can work profitably for you. You'll discover how its standard design gives you wide application flexibility, makes possible real savings in maintenance costs. The DP's operating record proves its reliability when there's a tough job to be done.



OUTDOOR INSTALLATIONS—No need to make special modifications when you move a DP out of doors. Totally enclosed governing system operating in its own oil atmosphere eliminates possibility of rusting or corrosion. You can operate a DP in hazardous atmospheres. Positive acting, non-sparking emergency governor protects the DP turbine against overspeed.



PRECISION GOVERNING—accurate enough for generator drives—is yours with the DP's hydraulic system. Regulation is 6 per cent with a 30 per cent range of speed adjustment. For process governing, regulator control is available.

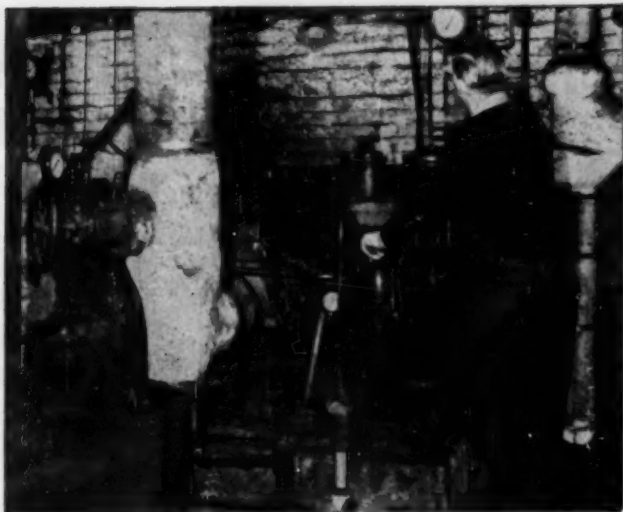
Ask your General Electric representative for full details about the DP mechanical-drive turbine, or write for bulletin GEA-4955, General Electric Company, Schenectady 5, New York.

GENERAL  ELECTRIC

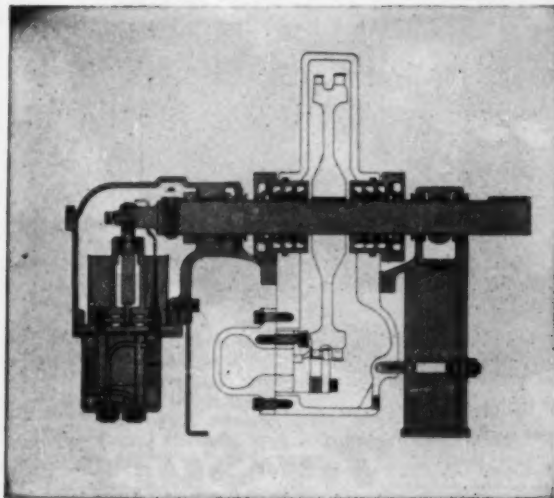
251-90



MECHANICAL- DRIVE TURBINES



DEPENDABILITY is built into the DP. Positive lubrication through automotive-type bearings adds years to the life of the turbine. Special steel nozzle plate, self-lubricating graphite packings, and Monel-sprayed shaft are examples of design features that spell reliability.



APPLICATION FLEXIBILITY As the shaded parts in the diagram illustrate, most DP parts are identical on all frame sizes and ratings. In this way, you can adapt a DP for different job requirements with only minor changes. A different nozzle plate gives you a new horsepower output. A change in governor gears provides a new speed range. DP's are rated from 10 to 1200 HP and 1000 to 5000 rpm, and with slight modification, can deliver up to 2000 HP and 10,000 rpm. During a change in plant operation, the DP's flexibility will save you money.



EASY MAINTENANCE Because most parts are interchangeable on all models, spares can be stocked at low cost. A spare parts kit, containing 91 items, can be obtained with the turbine. This simple method of stocking spares lowers maintenance costs and provides protection for several DP's in your plant. All models, regardless of frame size, horsepower, or speed ratings, have identical shaft height, keyways, and coupling fits. Thus, installation problems are simplified; you can move these center-line supported units from job to job without a custom line-up.

STERNS

LONDON · NEW YORK · PARIS

Established 1887



REGISTERED TRADE MARK

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- ★ Belgium
- ★ Egypt
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- ★ Japan
- ★ Morocco
- ★ New Zealand
- ★ Pakistan
- ★ Scandinavia
- ★ South Africa
- ★ South America
- ★ Spain
- ★ Switzerland
- ★ Tunis
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— one of the world's
pioneer oil companies —
uses **Tri-Sure Closures**
for world-wide protection



STERNS, LTD., founded in 1887, is not only one of the pioneer oil companies, but one of the first petroleum companies to stress the importance of quality and research.

Today, with shipments going to the principal markets of the world, you will see Sterns' drums in Tunis and Tokyo, in Bogota and Bombay. And on every Sterns' drum you will see Tri-Sure Closures*—guarding a 64-year reputation for quality.

Year after year, the world's most experienced shippers entrust their products to Tri-Sure Closures—because every test has proved that Tri-Sure protection is the best protection from leakage, tampering and losses.

When you order drums, make "Tri-Sure Closures" your No. 1 specification—and make every drum a guardian of your product, your prestige, and your customers' good will.



CLOSURES

* The "Tri-Sure" Trademark is a mark of reliability backed by 29 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

You Pay More For HEAT-FAG...



ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT



*... than for the blower
that keeps men cool*

When hot, stagnant or fume-filled air distresses you men, your production suffers too.

Give men around furnaces or hot processes, or in confined areas, a steady supply of fresh, cool air with Coppus Blowers and Exhausters and watch their efficiency jump to a more profitable level.

There's a portable, easily adaptable Coppus "Blue Ribbon" product for prac-

tically any fresh-air requirement. The Coppus "Blue Ribbon" is the sign of precision workmanship and trouble-free, long-lasting operation. Check and mail the coupon for exact information. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, BEST'S SAFETY DIRECTORY, MINING CATALOGS.

MAIL THIS COUPON To Coppus Engineering Corp., 227 Park Avenue, Worcester 2, Mass.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.

- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.

- ☐ exhausting welding fumes.

- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

NAME

COMPANY

ADDRESS

CITY

(Write here any special ventilating problem you may have.) }

OTHER

COPPUS


"BLUE RIBBON"
PRODUCTS

HORIZONTAL TURBINE
Six frame sizes —
1 to 150 horsepower

VERTICAL TURBINE
Six frame sizes —
1 to 150 horsepower

FANMIX GAS BURNER

FANMIX OIL BURNER



FACTS about the GLYCOLS

In times of shortages, steady profitable production is frequently endangered by the inability to get the proper raw materials. However, complete information about the various applications of chemical raw materials may help you use the materials currently in short supply in the most profitable manner. Despite today's shortages, Dow is also interested in helping you conduct experimental work with the glycols. Further research today may suggest new uses for the glycols, new ways in which they can serve you in future markets. For more information and technical assistance, write Dow using the coupon below.

The chemistry of the Glycols centers around the two hydroxyl groups which characterize them as glycols. They are intermediate in their properties between the alcohols with their single hydroxyl group and glycerine with its three hydroxyl groups. Like glycerine, the glycols are normally quite stable in air. At high temperatures, they tend to oxidize in air, giving rise to a wide variety of oxidation products such as aldehydes and acids. This oxidation can be reduced by the use of inhibitors so that the glycols can be used as heat transfer media.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

Properties and Specifications of the Glycols

	Chemical Formula	Molecular Weight	Specific Gravity 25/25°C.	Freezing Point °F.	Boiling Point °F.	Flash Point °F.	Fire Point °F.
Ethylene Glycol.....	$\text{HOCH}_2\text{CH}_2\text{OH}$	62	1.112	7	390	241	257
Diethylene Glycol.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	106	1.116	15	475	275	293
Triethylene Glycol.....	$\text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH}$	150	1.122	21	545	309	345
Propylene Glycol, Industrial.	$\text{CH}_3\text{CHOHCH}_2\text{OH}$	76	1.036	(-80)*	369	210	216
Dipropylene Glycol.....	$\text{HOC}_3\text{H}_6\text{OC}_3\text{H}_6\text{OH}$	134	1.025	(-54)*	446	244	253

SPECIFICATIONS

*Four Point

	Specific Gravity @ 25/25°C.	Boiling Range 760 mm. Hg 5 to 95%	Acidity, Max. (As Acetic Acid)	Water Max.	Color Alpha Max.
Ethylene Glycol.....	1.112-1.115	194-200°C.	0.01%	0.5%	15
Diethylene Glycol.....	1.115-1.118	240-250°C.	0.01%	0.2%	—
Triethylene Glycol.....	1.121-1.125	275-295°C.	0.01%	0.1%	60
Propylene Glycol, Industrial.	1.035-1.037	185-190°C.	0.005%	0.5%	10
Dipropylene Glycol.....	1.018-1.028	220-240°C.	0.01%	0.1%	20

This is No. 2 of a series of Dow advertisements you may wish to keep on file for reference and information. Write Dow for reprints.

SOLVENTS:



Glycols can be used to excellent advantage with materials which must be formulated with water, but which are not soluble in water. In this manner, Glycols can be used in cutting oils (soluble oils), textile lubricants, dry cleaning soaps, and industrial hand soaps to name a few applications. Glycols are used in the preparation of hydraulic fluids because of their solution compatibility, and in steam-set printing ink where the resins are dissolved in Glycols and precipitated by water or steam to set the ink.

Besides acting as solvents, Glycols offer stability and practicality because of their low volatility, high flash point, and favorable viscosity characteristics. For a better solvent, investigate the future role that Glycols can play in your production.



HUMECTANTS:

Is the "drying out" of your product cutting into profits? If so, consider the future job that Glycols can do for you. The ability of the Glycols to absorb moisture out of the air can be put to profitable use to secure: longer freshness for cigarette tobacco, baked goods and food; softening agents for paper; dehumidifiers for air and other gases; protection against the drying out of print pastes in textile processes. Glycols can also be added to sizes to prevent flaking. Be sure to start your experimental work with Glycols today if your materials are liable to excessive drying out.

*If you have a
Glycols problem*

WRITE DOW FOR INFORMATION AND
TECHNICAL ASSISTANCE.

ANTIFREEZE AGENTS:



The Glycols are most well-known for their use in permanent-type automotive antifreeze, and they also give dependable protection to water-containing materials subject to low temperatures. Some common industrial examples are: water-base paints, cooling sprays, water-base hydraulic fluids, glass cleaners, de-icing compounds, cleaning compounds, sprinkling systems, radiant heating systems, and aircraft water supplies.

One of the family, Ethylene Glycol, is reacted with Nitric Acid to produce a lower freezing dynamite. Glycols can replace salt in cooling brines where they decrease the corrosion factor. Glycols added to gas well effluent prevent the water present from freezing on cooling when removing casing head gasoline.



PLASTICIZERS:

For materials too brittle, Glycols are very effective as plasticizers. For example, by plasticizing the binder, Glycols add pliability and softness to composition cork sheets. They can be reacted with polybasic acids to give alkyd resins which are softer than corresponding ones made from glycerine. Other products which have been softened are moistureproof cellophane film, glues, some fibers and papers.

OTHER USES:

There are many examples of the versatility of the Glycols. Ethylene Glycol, for instance, in conjunction with Boric Acid and Ammonia is widely used in the manufacture of radio, radar, and television condensers: it is also used as a mold release fluid for asphalt grave vaults. Propylene and Triethylene Glycol, in vapor form, have been used in the control of air-borne bacteria. And, in some cases, the Glycols can be used as lubricants. Be prepared for future markets . . . start your experimental work with Glycols.

The Dow Chemical Company, Dept. OC-12,
Midland, Michigan

- ☐ Please send me additional literature about the glycols.
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DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY
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for maximum
furnace life

THERE is no one bonding mortar that is best for all conditions. Harbison-Walker manufactures more than a score of different classes and types, each of which has definite fields of applications. From this complete line, there can be selected the brand that will insure greatest economy, minimum maintenance and maximum furnace life for any service.

Harbison-Walker mortar materials comprise

Air-Setting cements for making brick joints which remain strong over the temperature range of their utility.

Hot-Setting mortars to provide a bond which is firm and impermeable at high temperatures, and also flexible to permit relief of stresses caused by expansion.

Developed through research, these mortars have the optimum combinations of properties such as workability, water retention, thermal expansion, strength, refractoriness, impermeability and resistance to fluxes and gases. Great care has been given to achieve a nicely adjusted balance in each Harbison-Walker brand.

Harbison-Walker representatives welcome the opportunity to assist you in the selection of bonding materials that will provide the best service and economy in your furnaces.



To secure full benefit from the superior properties of refractory brick an equally superior bond is essential.

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for every service

AIR-SETTING	Harwaco Bond	} High-Alumina
	Coralite Bonding Mortar	
	Korundal Bonding Mortar	
	Firebond—Siliceous	} Basic
	Thermolith—Chrome Base	
HOT-SETTING	Perikase Bonding Mortar	} Basic
	H-W Forsterite	
	Ankorite—High-Alumina	} Alumina-Silica
	H-W Fine Ground Fire Clays	
	H-W Super Duty Mortar	
	H-W Special Mortar Mix	
	Vega Bond	} Siliceous
	Starbond	
	Star Silica Cement	
	H-W Coke Oven Silica Cement	} For Insulating Brick
	H-W 20 Bonding Mortar	
	H-W 26 Bonding Mortar	
	H-W 444 Bonding Mortar	
	H-W Furnace Magnesite	} Basic
	H-W Special Furnace Chrome	

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through effective
resistance to
corrosion, heat
and abrasion

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In addition to an explanation of the different types of corrosion and recommended analyses for meeting the various corrosion problems, the catalog includes data on the following:

- Heat resistant castings
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- Dimensions on screwed, flanged and welding fittings
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Please send new catalog No. 175, "ESCO Stainless and High Alloy Products".

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V-RING PACKING CONVERSION KIT



A *Complete*

PACKAGED UNIT

This complete packaged Fisher Teflon V-Ring Conversion Kit converts a standard Fisher stuffing box unit to Fisher Teflon V-Ring Packing. It offers prompt service, guarantees a true fit and insures damage-free delivery.

When ordering, be sure to furnish the valve serial number found stamped on the patent plate attached to yoke or body.

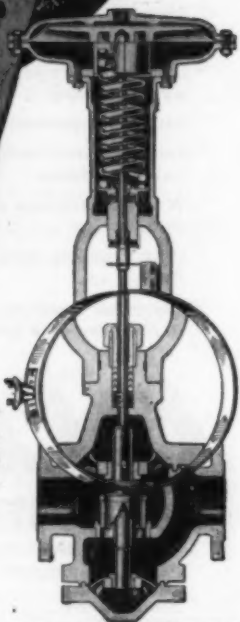
* Teflon is the trade name of E. I. DuPont de Nemours & Co.

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AND IN RESEARCH FOR BETTER PRESSURE CONTROL

Fisher Teflon V-Ring Packing is furnished as standard on new Fisher Diaphragm Motor Valves.





Naugatuck
ROYAL FAMILY OF PLASTICS

Naugatuck Marvinol is in your plastic future!

This could be the unveiling of a bright, new future for *your* products.

For the product wonders in this crystal ball have been worked by a marvelous material from which your products could be made — Naugatuck Marvinol vinyl resin.

Here is a Marvinol-made handbag — *soft and pliable* as leather — yet perfectly washable, and it *won't crack, peel, scuff or fade*.

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and feel. And colorful upholsteries with a *stability* that *holds their shape and fit*. And a snag-free zipper that closes with *no track!*

All these and hundreds more products can be made with Marvinol — rigid as steel, flexible as fabric, crystal clear or opaque, in all colors. In fact, Marvinol can be almost anything *you* want to make it.

Marvinol comes from the Naugatuck Chemical Division of the United States Rubber Company — a basic source of raw materials. It's in the plastics business to *stay and grow* with you. Write us and see what Marvinol can do for *you*.

Naugatuck Chemical

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MANY COMBINATIONS OF PROPERTIES are obtainable in Norton catalyst supports. Chances are that some of these combinations will meet your requirements. *Look at the choice you get.*

ALUMINA CONTENT — 77 to 89%
WATER ABSORPTION — 12 to 22% by weight
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CRUSHING STRENGTH — 20 to 600 pounds
BULK DENSITY — 60 to 80 pounds per cubic ft.
SIZES AND SHAPES — Spheres: $\frac{1}{4}$ " to $\frac{1}{2}$ " dia.; pellets: $\frac{1}{8}$ " dia. x $\frac{1}{8}$ " long to $\frac{1}{4}$ " x $\frac{1}{4}$;

rings: $\frac{1}{8}$ " inside dia. x $\frac{1}{4}$ " long x $\frac{3}{8}$ " outside dia. to $5\frac{1}{4}$ " x $\frac{3}{4}$ " x $\frac{3}{4}$ ".

Write for Samples

It will pay you to give Norton Alundum catalyst supports a thorough test. It is quite probable they will give you more uniform reactions and better end-products. Remember, Norton has had 40 years' experience in controlling the chemical and physical properties of fused alumina products. Write for samples. Norton Company, 504 New Bond St., Worcester 6, Mass.

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FLOW OF WATER, 1 foot head, through a Norton Alundum® porous plate of medium permeability.

Can Fused Alumina Porous Mediums IMPROVE YOUR FILTRATION, TOO?

It's easy to find out. A complete analysis by Norton engineers and research men of the use of Alundum fused alumina porous mediums for filtration, aeration and gas diffusion is now available in bulletin form.

Write for
 Bulletin
 140



This 16-page bulletin gives you all the data you need to decide whether Alundum porous mediums will improve your laboratory and commercial processes at lower cost. Tables, charts and drawings give you the facts about the amazing chemical stability, uniform permeability, great strength, and easy installation of Norton Alundum porous mediums. Contact your nearby Norton representative, or write direct for Bulletin 140.

NORTON COMPANY
 504 NEW BOND STREET
 WORCESTER 6, MASS.

We Mobilize for Freedom

CONTROLS . . .

A Two-Edged Sword

It may seem dangerously premature to talk about getting rid of emergency government controls while all-out war is still an imminent possibility.

But success in this strange struggle for our freedom into which the Russian Communists have plunged us requires that we:

1. Maintain a whole battery of controls designed to speed defense production and curb inflation, and at the same time
2. Work to end the controls at the earliest possible moment.

Here is the reason why this editorial—fourth in a special series on mobilization for defense—is devoted to the need for a speedy release from controls.

If the Russian Communists can force us to maintain indefinitely the present system of government controls, they will have won a tremendous victory. They will have saddled us with a system of collectivism which, over a period of years, would be fairly certain death to freedom of business enterprise.

Make no mistake about it. This is not an argument against emergency controls. We need controls now to break a right of way for

our mobilization program through the business boom. Indeed, the third editorial in this special series was titled "Why Controls Are Necessary." It stressed both the need for controls and the need for positive cooperation to make them work.

Controls Can Undermine Our Economy

But these controls surely chisel at the foundation of our normal economic system. So long as we have them, many if not most key business decisions will be made in Washington bureaus rather than in the free market place. For example, the *National Production Authority* administers a *Controlled Materials Plan* (italics ours) which directs the flow of basic metals, and decides who can use them for what purposes.

Happily, the people who operate these controls are not using the methods of a secret police state.

Even more happily, most of the leaders who have been drafted to manage the controls are not in love with their jobs. They are doing their best in the thankless task of making controls work. They recognize the danger of chronic controls.

But the fact remains that our economy is

operating under arrangements which carry it a long way toward the pattern of centralized control the Russians would inflict on the world.

The Wilson Plan

A plan for getting rid of these controls has already been developed. It was put together by our Director of Mobilization, Charles E. Wilson—while he was working day and night to set up the necessary emergency controls.

The Wilson Plan—if we escape all-out war—will strengthen our defenses and our economy. By 1953, it calls for:

1. Providing the weapons to equip an armed force of 3½ to 4 million, together with a supply of weapons for our allies.
2. Building a stockpile of weapons which, with current production, would be sufficient to carry on an all-out war for a year.
3. Building the manufacturing capacity by which we could rapidly expand our production of weapons if all-out war should come.
4. Increasing the productive capacity of industry enough to resume the expansion of our civilian economy.

With these jobs done our economy would be big enough and strong enough to meet both civilian and military requirements. And the government controls needed for mobilization could be speedily dropped.

Call for Sacrifice

The Wilson Plan requires a major effort—it means spending more than \$50 billion a year for mobilization. That is almost 20 percent of our total production. And this cannot be done without sacrifice. For a time, particularly in the next year, living standards will drop.

But the sacrifice required is amazingly small. At the peak of the defense effort, civilians will still have available to meet their needs about as much as they did in any year before 1948.

To make the Wilson Plan succeed we must curb inflation. A second year of inflation such as that which we have had since the Korean war started would multiply disastrously the costs of our defense program. One key part of a successful program to curb inflationary pressure, which soon will be building up again, is a pay-as-we-go tax program. The second editorial in this series urged that we do our utmost to pay as we go.

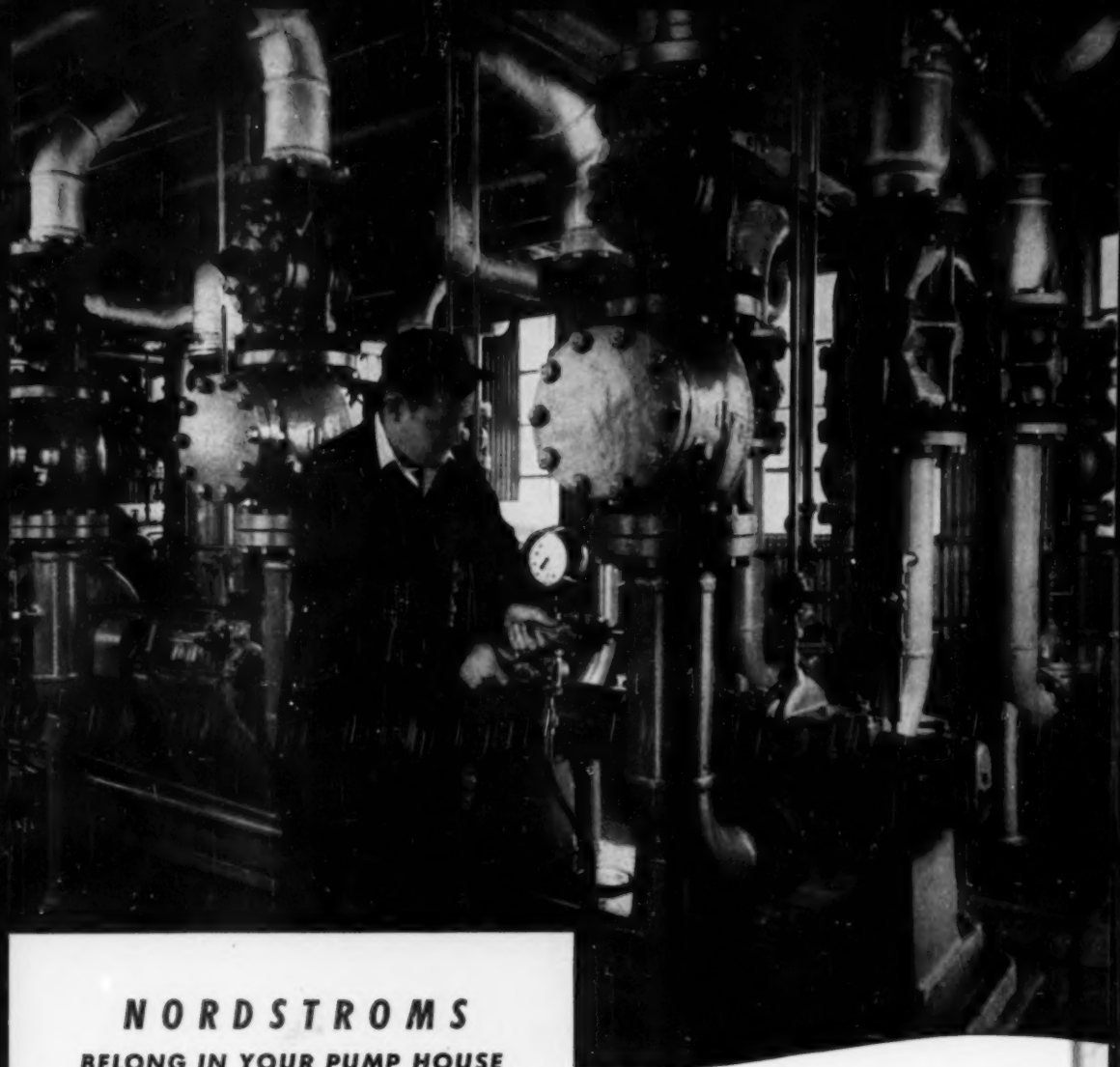
We Cannot Out-Control the Communists

But, above all, to make the Wilson Plan work we must keep our sights set on the crucial importance of increased production. Our problem is to increase our capacity to produce so that we can carry both a major military program and an expanding civilian economy for as many years—General Bradley thinks it might be fifteen or twenty—as the menace of Russian Communist aggression persists.

If we do not produce enough to do this double job, we shall be confronted with the prospect of having to live indefinitely under government controls of the sort that have been set up since the start of the Korean war. That would be delightful to the Russian Communists. It would go far toward making over our economy on the Moscow model.

Even if we wanted to, we never could hope to out-control the Russians. They are miles ahead of us in that line. But we can out-produce them, by a tremendous margin. By doing that we shall travel the surest road to victory.

McGraw-Hill Publishing Company, Inc.



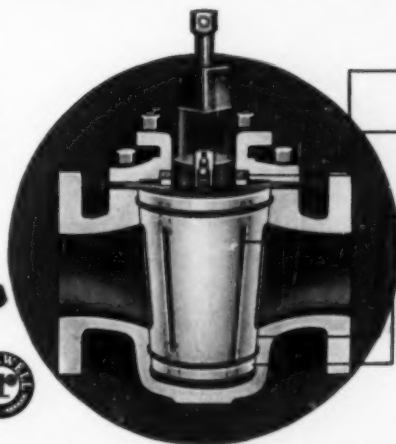
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Insure most dependable operation in
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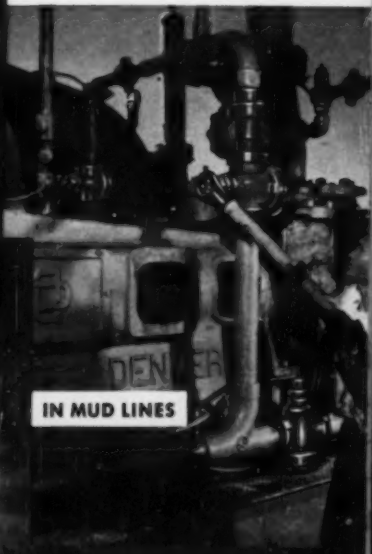
SEAT IS
 NEVER
 EXPOSED

TAPERED
 PLUG CAN
 BE JACKED

NORDSTROMS
—the choice
for
difficult
services



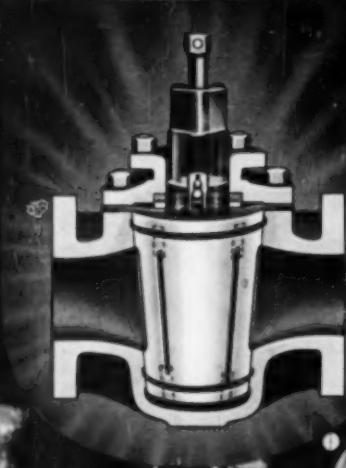
IN STEAM PLANT



IN MUD LINES



IN REGULATOR LINES



IN PUMP LINES

ROCKWELL



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Spotlight on SERVICE



American industry has the productive capacity . . . the skilled manpower . . . machinery . . . engineering ability . . . experienced management. Give it raw materials, and the finished products will roll off the assembly line in greater amounts than ever before.

That's a service job that Celanese is doing for many industries—producing volume quantities of organic chemicals that are basic materials in the manufacture of plastics, textiles, adhesives, laminates, paints, and finishes. Employing the most advanced methods in production, Celanese is operating on a round-the-clock schedule to meet the ever-increasing demand for these organics.

The modern Celanese chemical plant near Bishop, Texas, located in the heart of the gas fields, draws on nearby sources of natural gas to produce these

organic chemicals—assuring production continuity. Celanese also serves industry through experimental laboratories and pilot plants . . . a nationwide distribution system . . . and technical data and assistance backed by a generation of experience in petroleum chemistry.

Celanese Corporation of America, Chemical Division, Dept. 503-G, 180 Madison Avenue, N. Y. 16.



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AUTOMATIC CONTROL ENGINEERED DESIGN BY EQUIPMENT

HAMMEL-DAHL



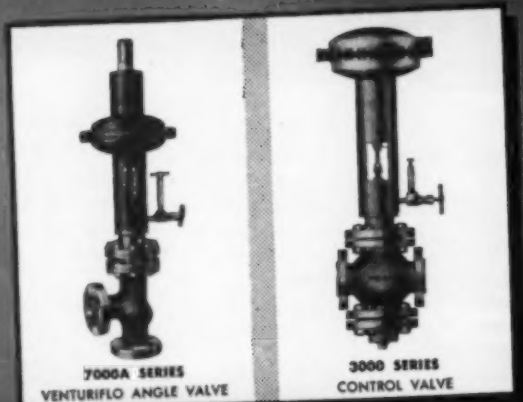
This special test panel in Shell Development Company's Instrumentation Laboratory, provides accurately controlled pressures, flow rates and electrical equivalents for testing and evaluating control devices.



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Whether it's precise control of
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What job do you have for
this new, chemically unique
wetting agent?

HOUGHTON

SURFAX 1288

• If you have a product you want wetter—faster—perhaps Surfax 1288 is the agent you've been looking for. Users have found many applications for this new surface active agent.

Surfax 1288 is chemically an *aroyl-sulfo-propionate*, exclusively a Houghton research development. It is a reddish amber liquid soluble in water at any working concentration. Plant tests have proved it to be unsurpassed as a wetting agent with good *rewetting* properties. In neutral or mildly alkaline solutions Surfax 1288 is unusually swift and effective.

**may be just the one your
wet processing
calls for!**

A study of Surfax 1288 can disclose many cost-saving benefits for your specific applications. Write for further information. Or send us a confidential outline of your specific wet processing problems. It will bring you a dependable appraisal of the ability of Surfax 1288—or perhaps another in our complete line of surface active agents—to help you. E. F. Houghton & Company, Philadelphia 33, Pennsylvania.

HOUGHTON SURFACTANTS
are available for practically any wet processing application—the result of 15 years of continuing research. Ask the Houghton Man when he stops in.


SURFAX 1288

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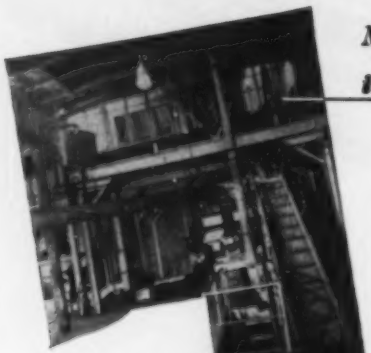


**Ready to give you
on-the-job service ...**



BETTER PROCESSING

EQUIPMENT INFORMATION FOR PROCESSING PLANTS



Main Floor
of granulating plant
gives glimpse of over-
all operations. Note
fire-proof construction, clean, compact
installation.

MODERN CORK REDUCTION PLANT *installs* **Sprout-Waldron Equipment** *... throughout!*

Illustrations show how Sprout-Waldron machines and engineering know-how tackled a diversified size reduction assignment.

The Hoosier Crown Corp., Crawfordsville, Indiana, makes cork seals for bottle caps.

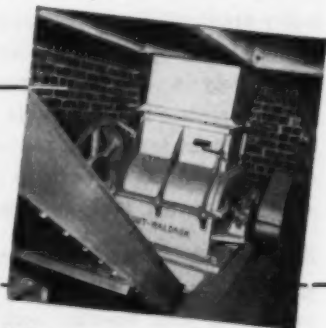
When it was decided to expand and modernize the Hoosier cork granulating plant, Sprout-Waldron was called on the job. Through close cooperation with S-W sales engineers, improved manufacturing techniques were developed. Equipment designed and built by S-W was installed to meet specialized processing requirements of Hoosier Crown Corp.

Today, installation photographs graphically illustrate another Sprout-Waldron "success story"—the story of successful operations achieved through the right combination of men, machines, and experience!

Consult with Sprout-Waldron on your processing problems.

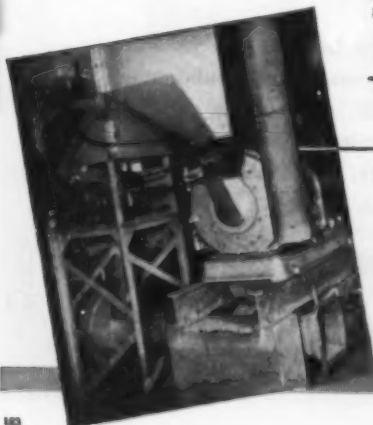
1st reduction

Preliminary crusher in basement makes first breakdown of cork blocker waste. Strips 10-12" long and 2" thick are reduced to 2" ring size. This unit has a higher production rate, and consumes only one-third the horsepower of previous equipment.



2nd reduction

The function of the 24" single runner attrition mill is to free the cork bark without cutting or shredding the cork wood. Equipped with specially designed plates, this mill provides a rubbing action which removes the friable "hardback" most efficiently.



SIZE REDUCTION

MIXING & BLENDING



pointers

BETTER PROCESSING

FOR FURTHER INFORMATION FOR PROCESSING PLANTS

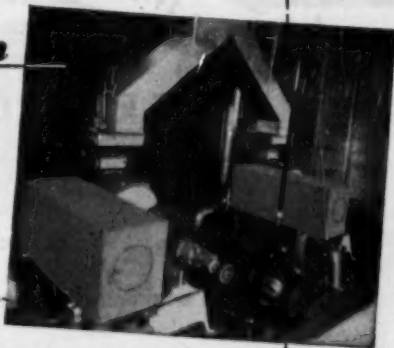


3rd reduction

After preliminary cleaning through bolting reel, cork is uniformly granulated to specified screen analysis by rotary knife cutter equipped with 25 HP motor. This refined cork product is now air-conveyed to two 16" buhr stone mills.

4th reduction

The two buhr stone mills illustrated serve as a buffing medium to put the finishing touches on the clean cork granules. The small shaker to the left of each mill sifts out and reclaims any cork flour produced by this scouring action.



the clean up!

For further information about Sprout-Waldron Processing Equipment, and Size Reduction Systems in particular, write to Sprout, Waldron & Co., Inc., 15 Waldron St., Muncy, Pa.

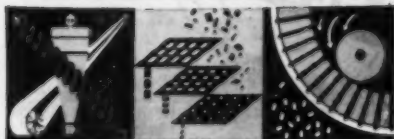
Sprout-Waldron

Manufacturing Engineers

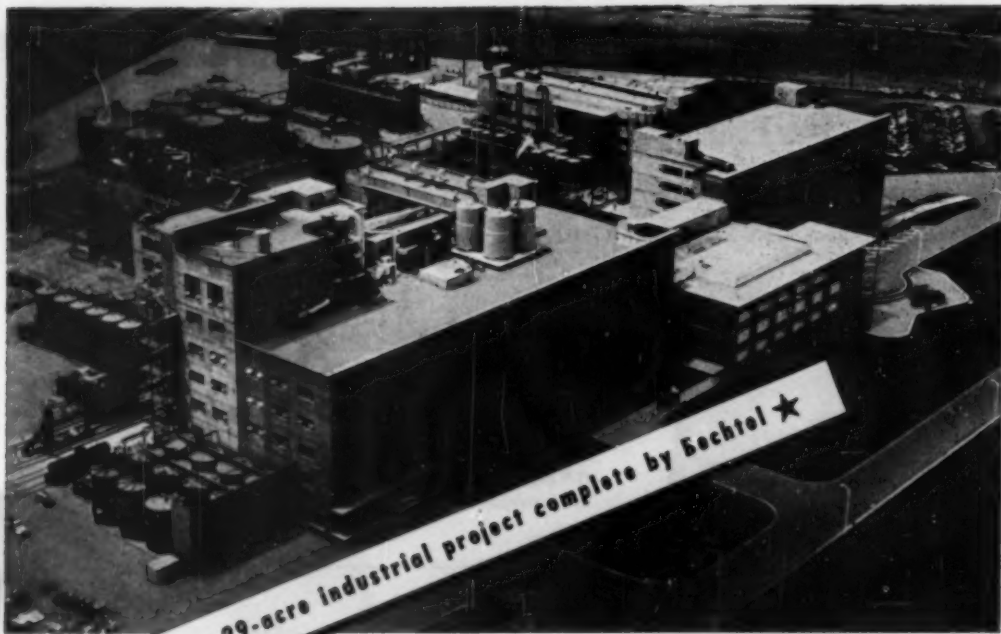
SINCE 1866

MUNCY • PENNSYLVANIA

From the buhr stones the buffed cork enters double disc aspirator for final "air-washing". Heavy, woody granules are removed and the clean light granules are picked up and conveyed by air to storage bins for further processing.



BULK MATERIALS HANDLING PRODUCT CLASSIFICATION PELLETIZING & CUBING



LEVER BROTHERS COMPANY

LOS ANGELES, CALIFORNIA

★ site survey, process analysis, design,
engineering, procurement, construc-
tion and machinery installation.

Bechtel services, suited to individual
requirements, are available for your
building program wherever located.

BUILDERS
FOR
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BECHTEL CORPORATION

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WHAT WOULD YOU SPECIFY ...

Fluid	Concentration	Temp.	Type of Valve	Valve Material
1 Sulfuric Acid	20%	120 F.		
2 Sulfuric Acid	100%	180 F.		
3 Hydrochloric Acid	20%	80 F.		
4 Hydrofluoric Acid	50%	120 F.		
5 Sew		200 F.		
6 Oxygen		Ambient		

In several of these cases other body materials or diaphragms would serve as well. But the really important fact is the unmatched versatility of Grinnell-Saunders Diaphragm Valves in handling corrosive fluids, gases, compressed air, food and suspended solids ... in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are problems.

Grinnell-Saunders Valve bodies are stocked in cast iron, malleable iron, stainless steel, bronze, and aluminum, with other materials available on special order. Valve bodies can be lined with lead, glass, natural rubber or neoprene. Diaphragms are available of natural rubber and a number of synthetics to suit particular service conditions.

The Grinnell-Saunders Valve Division will be pleased to submit recommendations upon receipt of complete information covering service conditions.

Features of the Grinnell-Saunders Diaphragm Valve

- diaphragm absolutely isolates working parts from fluid
- diaphragm lifts high for streamlined flow in either direction
- diaphragm presses tight for positive closure
- body, lining and diaphragm materials to suit service
- simple maintenance—diaphragm easily replaced



We supplied
Grinnell-Saunders
Diaphragm Valves
with ...

Body Material	Diaphragm Material
1 Rubber lined	Natural rubber
2 Cast iron	KEL-F
3 Glass lined	Butyl
4 Magnesium	KEL-F
5 Polished bronze	White diaphragms
6 Cast iron*	Neoprene

*For oxygen service a low flash point lubricant is supplied. All valves for oxygen service are subjected to 300 lb. air underwater test.

GRINNELL

WHENEVER PIPING IS INVOLVED



Grinnell Company Inc., Providence, Rhode Island

* Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermobar unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
Industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems



Life-Line motor
PAIRED FOR PRODUCTION
Life-Line starter



REGISTERED TRADE MARK

CORROSION?

Beat it with this Bonderized pair

You can install this Life-Line chemical motor and Life-Linestarter* team, any place and be sure. They're tough, dependable. Extra-protected, inside and out, and Bonderized to beat off corrosion's attacks. Look at the motor, for example.

Its specially treated, rolled-steel frame constantly has proved its ability to outlast conventional frames. Why?

In the first place, the frame is heavy-gauge, Bonderized steel. Then, special formaldehyde-alkyd-type enamel and succeeding layers of Thermoset varnish plus final lacquer are applied. That makes a tough hide to ward off corrosion's sabotage.

Too, Life-Line pre-lubricated, factory-sealed bearings guard against acid and other bearing enemies. This one feature alone has doubled

bearing life... multiplied it many times in some plants. Lubrication maintenance is eliminated.

Life-Linestarters are also Bonderized—the only standard Bonderized starter available today at no extra cost. That's why, in corrosive atmospheres, the Life-Linestarter has rendered substantial savings to users. In places where local electrical codes formerly specified expensive, hot-dipped galvanized or cadmium-plated enclosures, the Life-Linestarter is now acceptable.

Together, you can't beat this team for corrosion resistance. Put them together on your applications and save. Discuss the details with your Westinghouse representative. He has the facts to help you stop corrosion raids. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21630

YOU CAN BE SURE... IF IT'S
Westinghouse

Life-Line

MOTORS and CONTROLS





*A partial list of
other Oronite Chemicals*

NOTE!

Some of the following products
including the wetting agents
are currently in short supply.

Detergent Alkane
Detergent Slurry
Detergent D-60
Lubricating Oil Additives
Cresylic Acids
Gas Odorants
Polybutenes
Purified Sulfonates
Naphthenic Acids
Phthalic Anhydride
Ortho Xylene
Para Xylene
Xylol
Aliphatic Acid
Hydroformer Catalyst

Why men who know specify Oronite

The maintenance of high quality standards in mass production of industrial chemicals has established Oronite as a prime source of supply to the chemical and processing industries. This combination of quality and quantity is reflected in a group of Oronite's

Surface Active Agents

which are being used in a variety of products and processes

The great variety of uses for the many Oronite Surface Active Agents covers everything from textile processing to ore flotation. Typical application of three such Oronite products are shown below.

WETTING AGENT "S" is an outstanding emulsifier for alkyd and vinyl resins and polymerized butenes. Its use improves water type surface coatings by increasing spreading and penetrating power. It is useful in the grinding of pigments and as a dispersing agent for pigments and dry colors.

ORONITE D-40, while primarily a detergent, also has high surface active properties which make it an ideal wetting agent in compounds marketed in dry powder or slurry form. Used in water soluble pastes and glues, D-40 increases spreading power and penetration, facilitates mixing.

SODIUM SULFONATES find valuable application as components in metal de-greasing compounds because of their ability to emulsify oils and greases. They are also valuable as detergent solubilizers, and as components in soluble oils, cutting oils and ore flotation reagents. They are produced in grades ranging from low molecular weight (water soluble) to high molecular weight (oil soluble).

If you are interested in improving your processing or developing better products through the use of Surface Active Agents, write to Oronite for more detailed information.



As emulsifiers in such products as surface coatings.



In adhesive compounds such as wallpaper paste.



In metal cleaning and de-greasing preparation.

ORONITE CHEMICAL COMPANY

12 SANOME ST. SAN FRANCISCO 4, CALIF.

30 ROCKEFELLER PLAZA NEW YORK 20, N.Y.

STANDARD OIL BLDG. 105 ANGELES 14, CALIF.

800 S. MICHIGAN AVENUE CHICAGO 5, ILL.

MERCANTILE SECURITIES BLDG. DALLAS, TEXAS

COMPARE

THIS FEATURE

OF THE HONEYWELL

SERIES "700"

VALVE

* Compare the selection of discs available with this valve with that of any other wide band proportional type. Look at them closely... see how they permit you to select the disc which meets your specific requirements.

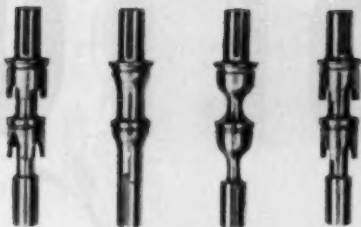
Then check the other features of the valve... the Specially Designed Diaphragm, the Duplex Upper Stem Guide, the One-Piece Bonnet, the Packless Bellows Seal, the Safety Stem Lubricator, the easy reversibility in the field.

Your comparison will prove that the Honeywell Series 700 has all of the features you look for in a fine valve.

It's available in a wide range of styles and sizes. For detailed information, write for a copy of Catalog 700-2, or call in your local Honeywell engineer... he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Industrial Division, 1904 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

*New Bulletin 750,
"Control Valve Sizing Data,"
is now available*



VARIETY OF DISCS

A wide variety of discs to meet the most exacting process requirements. Included are V-port and contoured discs in either linear or percentage styles, as well as flat discs for on-off service. All discs are ground and polished... all seating surfaces are lapped to assure tight fitting.



Specially Designed
Neoprene Diaphragm

Duplex Upper
Stem Guide

One-Piece
Bonnet

Packless
Bellows Seal

Safety Stem
Lubricator

Reversibility
in the Field

MINNEAPOLIS Honeywell

VALVE PRODUCTS

OLIVER

Pressure

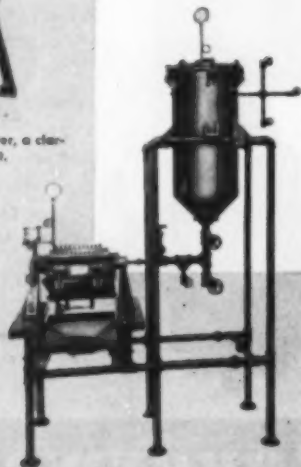
FILTERS

For Those Filtration Jobs

on the Plus Side of the Pressure Gauge ►



Oliver Pressure Filter, a clarifying unit.



Sweetland Pressure Filter, laboratory and pilot plant unit with pressure feed tank.



Kelly Pressure Filter—'Packaged' unit for handling molten sulphur and for special uses.

Forty-four years of filtration experience has proved one thing beyond any question. It has proved that to be of most use to industry, a filtration, engineering and manufacturing service should be able to offer designs in all three broad classes of filters: continuous vacuum, continuous pressure, and batch pressure.

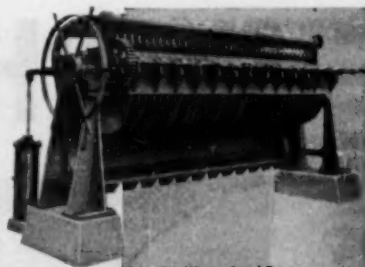
How can a service be fully helpful without all three?

Many problems are definitely in the pressure filtration class; others are borderline. That's why we have developed and are continuing to develop an extensive line of pressure filters. Several of these Oliver United Pressure Type Filters are illustrated here. Included are low pressure and high pressure batch filters, continuous pressure filters, precoat pressure filters, clarifying filters, jacketed filters . . . all in a wide range of sizes and materials of construction. The record of these pressure filters reveals excellence of design, sturdiness of construction, and efficiency of operation. They are worthy complements of the many continuous vacuum filters we have made available to industry through our world-wide organization.

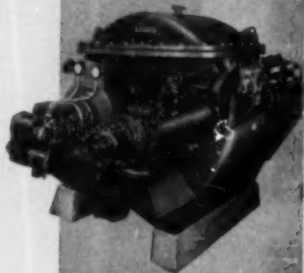
When you bring your problem to us, you can be assured of an unbiased recommendation. We have no ax to grind. We have filters in all three classes of filtration: continuous vacuum, continuous pressure, and batch pressure. And we have complete testing facilities to determine the best type of filter for each individual problem brought to us.



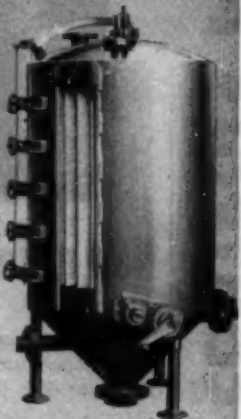
Standard Kelly Pressure Filter.



Standard Sweetland Pressure Filter.



Oliver Precoat Filter, continuous pressure type.



Oliver-Boatty Pressure Filter, a clarifying filter with radially positioned, vertical leaves.

New York 18 - 33 W. 42nd St. Chicago 1 - 221 N. LaSalle St.
Oakland 1 - 2900 Glascock St. San Francisco 11 - 260 Calif. St.
Export Sales Office - New York • Cable - OLIUNIFILT

FACORIES:
Hazleton, Pa.
Oakland, Calif.

OLIVER UNITED FILTERS



WORLD WIDE SALES, SERVICE AND MANUFACTURING FACILITIES

CANADA

E. Long, Ltd.
Ottawa, Ontario

MEXICO & CENT. AMERICA

Oliver United Filters Inc.
Oakland, Calif.

INDIA

Dorr-Oliver (India) Ltd., Bombay

EUROPE & NORTH AFRICA

Dorr-Oliver S. A. Brussels
Dorr-Oliver S.N.A.R.L. Paris
Dorr g.m.b.h. Wiesbaden (14)
Dorr-Oliver Co., Ltd., London, E.W. 1
Dorr-Oliver S.a.R.L. Milano
Dorr-Oliver, N.V. Amsterdam-C

PHILIPPINE ISLANDS

E. J. Neil Co.
Manila

HAWAIIAN ISLANDS

Honolulu
A. R. Duvall

WEST INDIES

Wm. A. Pave - Havana

SOUTH AMERICA & ASIA

The Dorr Co.
Stamford, Conn.

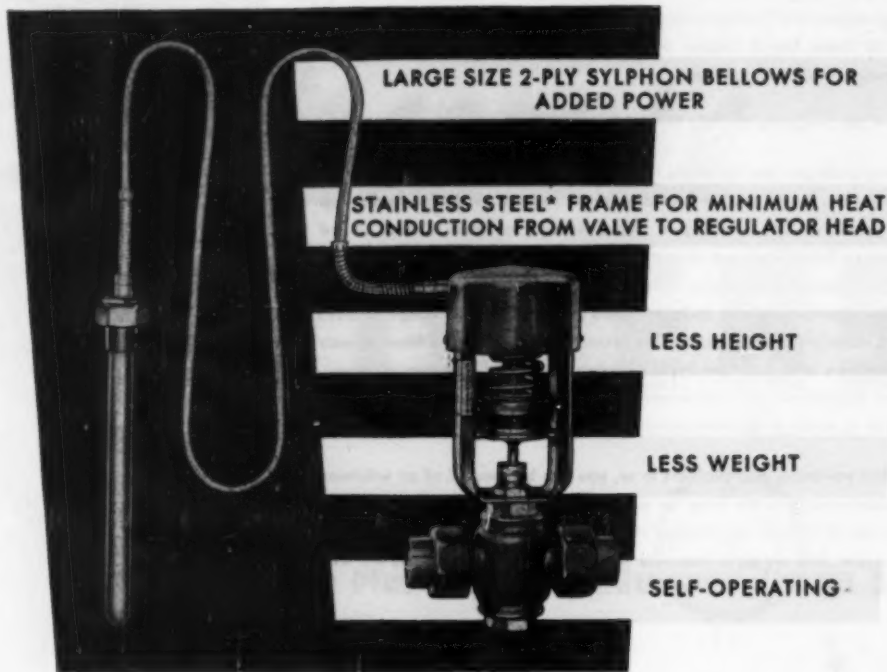
AUSTRALIA

Hubert Duff Pty., Ltd.
Melbourne

SOUTH AFRICA

E. I. Bateman Pty., Ltd.
Johannesburg, Transvaal

SYLPHON No. 999



New, more powerful, more compact temperature regulator!

For all industrial processes requiring accurate temperature control, this new Sylphon regulator does the job better than ever! It is particularly suited for storage water heaters . . . metal plating tanks . . . bottle washers . . . treaters . . . slashers, etc.

It requires no compressed air or other auxiliary power source. It's simply and sturdily constructed, ideal as standard equipment.

Its new features give added assurance of uniform processing conditions, better performing equipment. Wasteful over-heating is prevented, fuel saved.

No. 999 is also available with fin type bulb for controlling temperature of air and gases. No. 999-A has over temperature protection; No. 999-T is equipped with dial indicating thermometer. Write today for complete details. Ask for Catalog NCA.

**Contingent upon materials availability.*



FIRST WITH BELLOWS

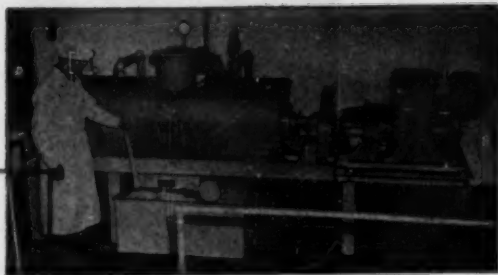
Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
DIVISION

ROBERTSHAW-FULTON CONTROLS CO. KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal

*VACUUM helps you
improve processes...
make new products...
cut costs!*



Stokes Vacuum equipment installed in the plant of John Morrell & Co., meat packers, Ottumwa, Iowa, for extensive test runs on development of new products and improvement of old products and methods.

The elimination of normal air pressure and oxidizing influences during the processing of chemicals, plastics, paints, rubber, pharmaceuticals and other products results in revolutionary effects.

Materials which are altered or impaired by heat or oxidation under atmospheric conditions can be processed under vacuum at lower temperatures, with better or different results; often with less labor and usually at lower cost.

Almost every product which is affected by air invites examination of its behavior under vacuum. Many manufacturers—for example John Morrell & Co. of Ottumwa, Iowa—install Stokes Vacuum equipment for extensive test runs calculated to result in new products or in the improvement of accepted products and processes.

Other manufacturers look to Stokes engineers for assistance in vacuum processing, counting on Stokes extensive experience in the vacuum field, on semi-plant-scale facilities to test proposed methods and materials, and on Stokes recognized authority in vacuum processing.

STOKES

STOKES MAKES

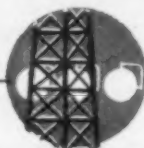
Plastic Molding Process,
Industrial Tabletting
and Powder In-Pel Process,
Pharmaceutical Equipment,
Vacuum Processing Equipment,
High Vacuum Pumps and Seals,
Special Machinery

F. J. STOKES MACHINE COMPANY, 2100 FALCON DRIVE, PHILADELPHIA 26, PA.



where stainless steel tubing

is required —



TRY TRENTWELD

Stock lines in food, paper, and chemical plants; heat exchanger units in processing industries; cooling coils in breweries, beverage industry, dairies and dairy equipment . . . throughout all industry, wherever there's a stainless or high alloy tubing application, there you'll find TRENTWELD.

And it's to be expected! TRENTWELD is made in a tube mill by tube engineers who roll and weld stainless and high alloy tubing *exclusively*. Then too, TRENTWELD is available in a full range of sizes — $\frac{1}{8}$ " to 36" in diameter. This coupled with Trent's convenient mid-continent location means prompt delivery of what you want . . . when you want it. If yours is a stainless or high alloy tubing requirement: Call on us, TRENT TUBE COMPANY, *Subsidiary of Crucible Steel Company of America*. General offices and plant: East Troy, Wisconsin; Sales offices in principal cities.

TRENTWELD

STAINLESS STEEL TUBING

LINK-BELT Silverstreak Silent Chain Drives

deliver full-rated hp

**Slip-proof
Slap-proof
Shock-proof**

There's no stretch, no slippage with Link-Belt Silverstreak Silent Chain Drives. You're sure of *positive* transmission of every unit of horsepower your motors develop. For every rating, every design has been proven 98.2% efficient.

You conserve space, too—Silverstreaks operate efficiently on extremely short centers. Ratios as high as 10-to-1 are commonly used.

For high speeds—for tough operating conditions—for years and years of trouble-free service—you can't beat Link-Belt Silverstreak Silent Chain Drives.

Silverstreak Silent Chain does the job with a single strand—eliminating the dangers that come with one or more belts in a group carrying more than their share of the load.

Musky Silverstreak metal link construction combines the ability to carry heavy overloads with the resilience that really absorbs shock.

"Pull" is distributed equally across Silverstreak Silent Chain. No possibility of uneven running—slapping.

Silverstreak Silent Chain doesn't rely on tension to get pulling power—chain meshes with teeth—gives **POSITIVE** drive—no chance for slip.

LINK-BELT

SILVERSTREAK SILENT CHAIN DRIVES

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices Factory Branch Stores and Distributors in principal cities.

ENR 100

DUST and FUME Control

CONTAMINATED
AIR INTAKE

CLEAN AIR OUTLET

Special equipment engineered to solve individual problems posed by dusts of all kinds, fly ash, chemical fumes, gases of high or low temperature, aerosols, and other troublesome air pollutants.

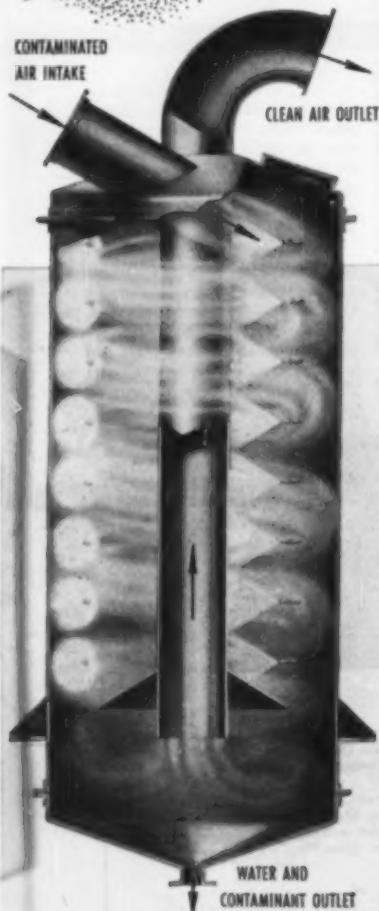
In dealing with air contaminants, each individual air cleaning problem must be approached with a view to determining what type of collector or filter is required to produce maximum results under existing conditions. Study and analysis of the character and extent of the pollutant is therefore imperative in arriving at a satisfactory solution. Mahon dust and fume control engineers have, over a period of years, developed and perfected special Wet and Dry Collectors and Fog-Filters which have proved highly successful in coping with all types of industrial air contaminants—a few are illustrated here . . . they are serving today in some of the most difficult and mandatory air cleaning jobs in industry. Each installation has been engineered to do the specific job. If you have an air pollution problem, regardless of its character, it will pay you to call in a Mahon engineer and let him show you what Mahon equipment has done with like pollutants under conditions comparable to your own. See Mahon's Insert in Sweet's Mechanical Industries File for further information, or write for Industrial Equipment Catalog A-650.

THE R. C. MAHON COMPANY

Main Plant and Home Office, Detroit 34, Michigan

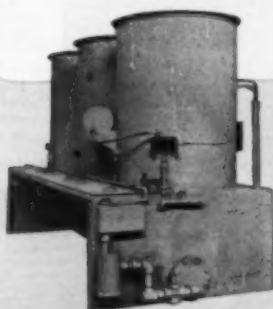
Engineers and Manufacturers of Dust and Fume Control Equipment Including Cyclone Collectors, Hydro-Foam Collectors, Jet Trap Collectors, Hydro-Filter Collectors, and Fog-Filters and Cupola Stack Washers.

All Mahon Equipment is Erected by Mahon to Insure Complete Satisfaction.



MAHON FOG-FILTER

This Mahon Fog-Filter is designed primarily for removal of air contaminants of less than 10 microns in size, and to provide industry with a less costly precipitator for mists, fumes, high temperature gases and other fractional micron air contaminants which would escape other types of collectors.



Mahon Hydro-Foam Dust Collector



Mahon Jet Trap Dust Collector

MAHON

GLYCERINE



**IMPORTANT
FOR
FOODS...**



...IMPERATIVE FOR NATIONAL DEFENSE!

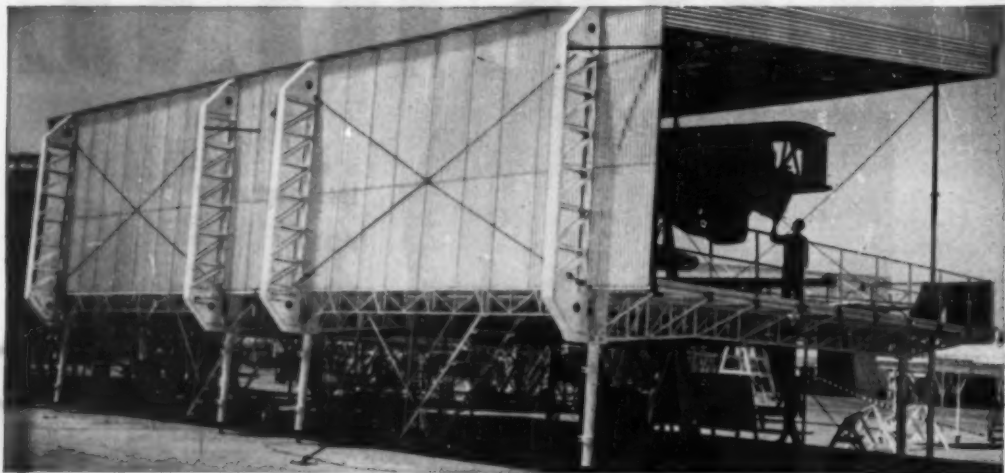
In soda fountains... bakeries... butcher shops and grocery stores... you'll find versatile Glycerine lending its unique range of properties to hundreds of foods and beverages. Glycerine compares to carbohydrate in food value—and it's an important humectant, sweetener, solvent and preservative besides!

Important for foods, yes—and so vital is Glycerine to our defense efforts that it was one of the first six chemicals to be put under inventory control*! In the days to come, you may find supplies of Glycerine temporarily restricted... for the most part because this valuable product is on the job helping meet military demands for foods... explosives... and a host of other vital products.

*By Government authorities responsible for inventory control under the National Defense Act.
GLYCERINE PRODUCERS' ASSOCIATION
295 Madison Ave., New York 17, N. Y.

Maintenance Dock

for the world's biggest warplane



No Maintenance for its roofing and siding

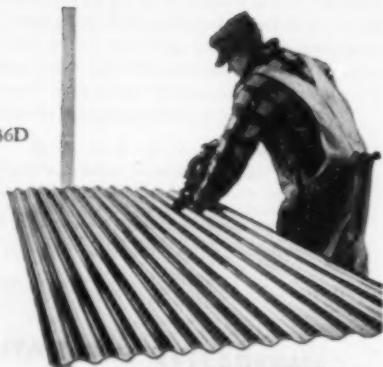
When Consolidated Vultee engineers designed a maintenance dock for the B-36D jet-augmented bomber, they naturally turned to the "aircraft metal" for the closed side and roof—rustproof, corrosion-resistant aluminum.

Reynolds Lifetime Aluminum Industrial Corrugated has ample strength for industrial use (see specifications). Yet it weighs only 56 lbs. per square. That's important in this structure that moves up and down on hydraulic jacks; it's important for framing economies in any structure. And aluminum's radiant heat reflectivity is another advantage—important under the California sun of this Lindbergh Field, San Diego, installation—important in any plant, to keep interiors cooler in summer and warmer in winter.

Call on us for literature, for technical assistance, application details...

- Offices in principal cities. Check your classified phone book for our listing under "Building Products," or write: Reynolds Metals Company, Building Products Division, 2005 South Ninth St., Louisville 1, Ky.

Aluminum is required for planes and other military needs. Reynolds Lifetime Aluminum Industrial Corrugated is still produced, but the total supply is necessarily reduced. DO-rated orders receive priority handling.



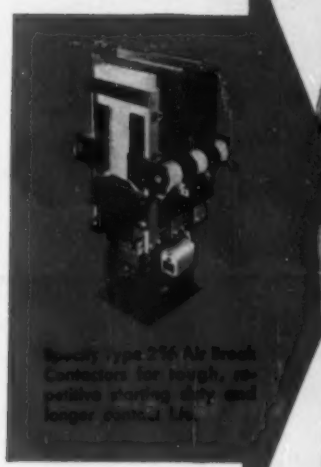
Specifications for Reynolds Lifetime Aluminum Industrial Corrugated:

Thickness .032"
Corrugations 7/8" deep, 2-2/3" crown to crown
Uniform load support (roof) 80 p.s.f. on 4' purlin spacing
Uniform wind load capacity (siding) 20 p.s.f. on girt spacings up to 7'9"
Roofing width 35", coverage 32"
Siding width 33-3/4", coverage 32"
Lengths 5', 6', 7', 8', 9', 10', 11', 12'



REYNOLDS *Lifetime* ALUMINUM INDUSTRIAL CORRUGATED

Type H Starters
FOR 2300 TO 5000
VOLT MOTORS



Specify Type H Air Break Contactors for tough, repellent starting duty and longer contact life.



Select Type MO or Immersed Contactors for normal duty or for service in dust, loose, corrosive or very wet atmospheres.

Engineered to Your Needs!

EVERYTHING you need for complete control and protection of your motors is engineered as a single unit when you specify Allis-Chalmers Type H Starters.

Air break or oil immersed contactors . . . whichever is best suited to your application . . . may be built into your Allis-Chalmers Type H Starter. Meters, overload relays, current limiting fuses, auxiliary switches — all needed parts are selected to meet the requirements of your application . . . then assembled into an attractive, easy to install steel cabinet. Type H Starters are compact to save floor space, compartmented to simplify maintenance and protect personnel.

There is a Type H Starter to fit your needs. For full or reduced voltage starting, for reversing or dynamic braking . . . to control squirrel-cage, wound rotor or synchronous mo-

tors . . . Allis-Chalmers Type H Starters will be your right answer.

Remember, they are engineered for dependability, designed for ready access and built to give long life with low maintenance. Call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wis. for bulletin 14B6410A.

A-3353

MAXIMUM HORSEPOWER

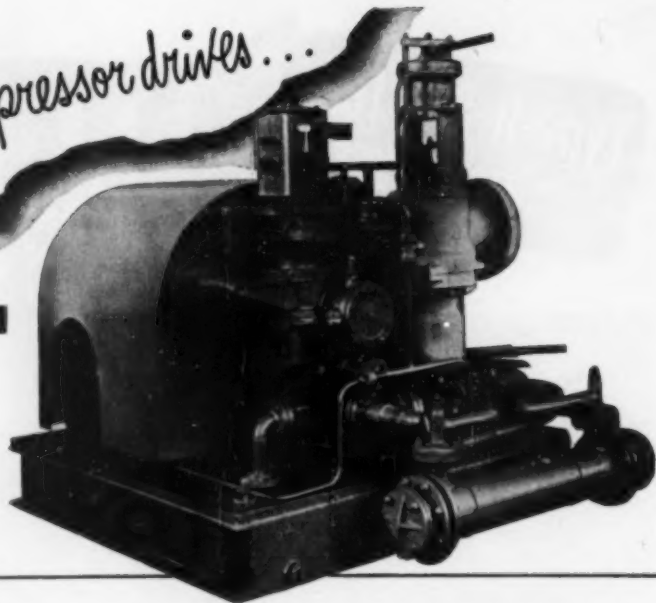
Type of Contactor	2000-2500 Volts			4000-5000 Volts		
	Synchronous		Induction	Synchronous		Induction
	1.0 PF	.8 PF		1.0 PF	.8 PF	
Air	1500	1250	1250	2500	2250	2250
Oil	800	700	700	800	700	700

ALLIS-CHALMERS



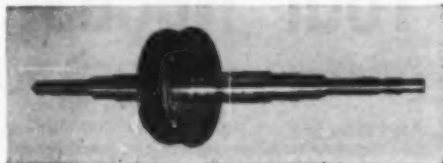
*For your
centrifugal compressor drives...*

**WORTHINGTON
HIGH
SPEED
TURBINES!**



***Developing Up To 12,000 RPM, Worthington Turbines Are Outstanding
For Driving Modern High Speed Centrifugal Compressors***

Meeting the demand for steam turbine drivers for high speed machines, Worthington has developed a line of high speed turbines, many of which are already in operation. Smooth, steady driving power for blowers and centrifugal compressors is assured by a powerful oil relay governor — usually arranged for variable speed, either manually or through an outside controller.



Typical of the rugged construction of these turbines, the rotor illustrated is a single solid forging, with wheels and shaft integral. This rotor develops 3860 hp at 9150 rpm when supplied with steam at 600# G, 750° FT and 185# G exhaust.

***For Your Motor Driven
Centrifugal Compressors***

Worthington precision cut, high speed step-up gears increase motor speed to compressor speed. Gear teeth contours are carefully selected and machined for quiet operation and long life, while latest design high speed bearings reduce wear and assure trouble-free performance.

Get the facts on how these money-saving, always dependable turbines and gears prove there's more worth in Worthington. Write to Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, New York.



WORTHINGTON



STEAM TURBINES

**A GREAT
TEAM
IN
STEAM**



Feed Water
Pumps



Steam Engine
Turbines



Industrial
Pumps



Turbine-Governor
Sets



Steam Engine
Turbines



Feed Water
Pumps

TO.4

Which tube steel is the one and only for you? Ask the experts!

This month's report is on:

SICROMO 5S

High degree of surface stability under oxidizing conditions up to 1500°F., makes it excellent for air preheater tubes, recuperator and superheater tubes, incinerator equipment. In cracking tubes, offers good resistance to corrosion by hot petroleum and excellent stability up to 1500°F.

23 TIMKEN STEELS FOR HIGH TEMPERATURE SERVICE

Carbon	Sicromo 2	Sicromo 5S	16-13-3
Carbon-Mn.	Sicromo 2½	Sicromo 5MS	25-20
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-12
Silmo	Sicromo 3	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	

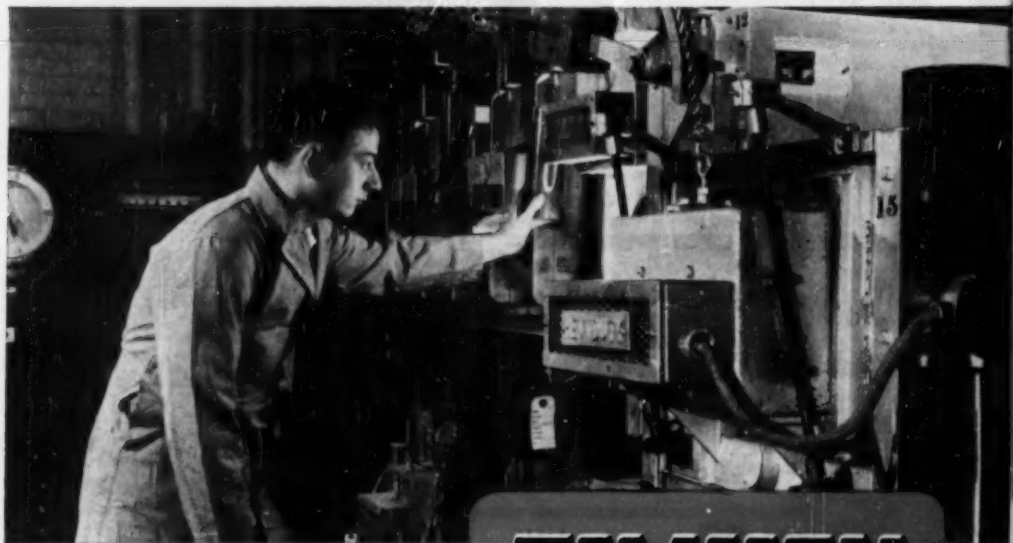
*Not available as seamless tubing at the present time.

One and only one high temperature tube steel can give the best life/cost ratio under a particular set of heat, pressure, corrosion and oxidation conditions.

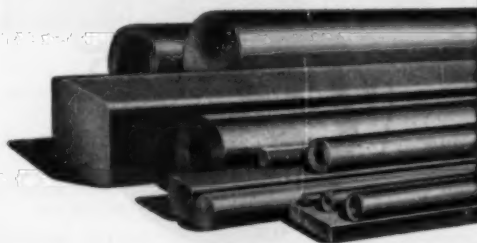
To make sure you select the right steel for your operating conditions, get the help of the recognized authorities on high temperature steels—the Timken Company's metallurgists. Their knowledge has been gained through the development and testing of 23 analyses to solve specific high temperature problems. They'll help you choose the one steel out of the 23 that will give you the most life per dollar. And you can be sure that analysis will be uniform from shipment to shipment, because of the Timken Company's complete quality control.

Let our "RSQ"—Research, Supply, Quality—solve your tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

Photo shows furnaces in the Timken Company's experimental heat treating laboratory. Pioneering research on high temperature steels' properties is one big reason for the Timken Company's leadership.



YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

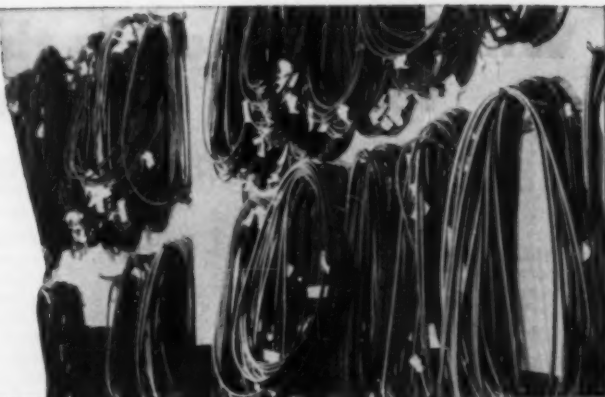


TIMKEN
Fine Alloy
STEEL
and Seamless Tubes

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphite and standard tool analysis—and alloy and stainless seamless steel tubing

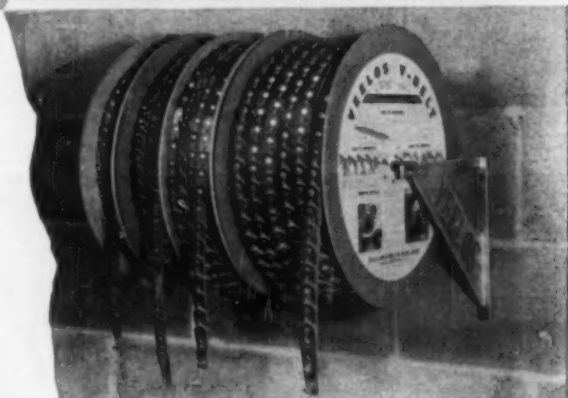
Why carry this Costly Inventory?

When you switch to Veelos—the adjustable v-belt—you end for all time the storage problem, the inventory control problem and the "frozen investment" problem that come with carrying this expensive, space-wasting stock of endless v-belts.



4 reels of VEELOS is your Complete Inventory

With just these 4 reels of Veelos you can take care of *every* v-belt need in the O, A, B and C widths—these 4 reels replace up to 316 sizes of endless v-belts... and you have the right size belt when you need it. There's no storage or control problem—inventory costs are at a minimum.

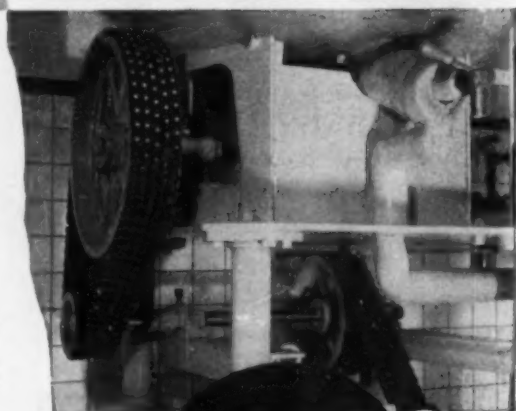


and VEELOS provides Peak Machine Production

Vibrationless, full power delivery—simple, easy adjustment to maintain uniform tension on all belts—quick installation (unnecessary even to dismantle outboard bearings) these are Veelos advantages that mean maximum production.



We have a copy of the
VEELOS DATA BOOK
for you—write today and we'll
send you this complete story on
Veelos—the adjustable v-belt.



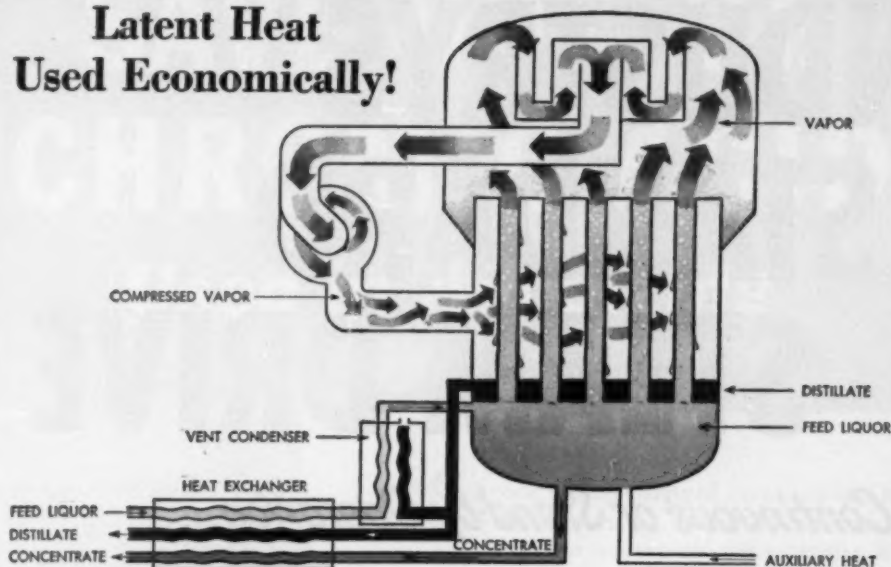
ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

MANHEIM MANUFACTURING & BELTING COMPANY • MANHEIM, PENNA.



Latent Heat Used Economically!



The Merit Of Compression Distillation Lies In The Fact That Latent Heat Is Constantly Being Reclaimed and Utilized . . . Recycling Through The Evaporator

In order to start the cycle of operation, an auxiliary heat source is generally provided through either a direct steam supply, internal combustion engine heat, or directly applied immersion heaters. When the original supply of raw liquid has reached the boiling point, using auxiliary heat, the compressor is started into operation.

The vapor rises from the boiling raw liquid into the evaporator through an efficient steam separator where the entrained particles are removed. The vapor is then drawn into the compressor where heat is applied by mechanical means thus increasing the pressure and temperature by a relative amount.

The vapor is then forced into the lower section of the evaporator and across the outside surfaces of the tubes containing the boiling raw liquid. The vapor, coming in contact with the raw liquid through the tube medium, transfers its latent heat of evaporation. There it condenses and drops to the tube sheet where it is carried off as pure distillate. Likewise a new supply of vapor has been produced in the tubes and it rises to continue recycling.

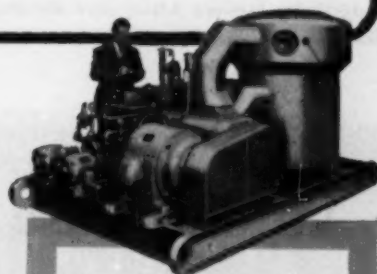
During evaporation concentrated liquids in the bottom head are carried off at a predetermined rate for recovery and disposal.

Cleaver-Brooks Compression Stills offer unequalled Economy in three Distinct and Separate Applications:

- EVAPORATION FOR RECOVERY:**
to recover valuable solids or concentrates.
- EVAPORATION FOR DISPOSAL:**
to reduce volume of objectionable wastes.
- WATER PURIFICATION:**
in quantity and quality.

CLEAVER-BROOKS CO., 375 E. Keefe Avenue, Milwaukee 12, Wisconsin

Available in standard size units from 15 G.P.H. to 2500 G.P.H., motor, engine, or turbine drive. Larger sizes to fit specific applications can be constructed for field erection. Write for bulletin "Compression Distillation."



Cleaver-Brooks

Builders of equipment for the generation and utilization of heat.

INDUSTRY'S STANDARD STEAM DRIVE!

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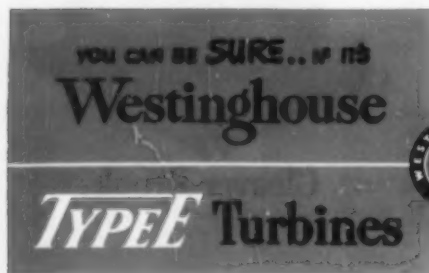
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How this Horton* Structure Profitably Recovers Coke Fines

*By Horton structure, we mean the bottom and shells of the Dorr thickener unit shown in the illustration at the right and below.

This unit is located at the East St. Louis refinery of the Socony-Vacuum Oil Company. It separates coke fines from water used in a hydraulic decoking process.

In the hydraulic decoking process, streams of high-velocity water are used to remove the coke from the drum. Most of the coke is cut into large lumps that fall from the drum directly into a railroad car. An appreciable quantity, however, is in the form of small particles—coke fines—that remain in suspension in the water.

The thickener concentrates these fines so they can be recovered. The unit also clarifies the water so it can be re-used.



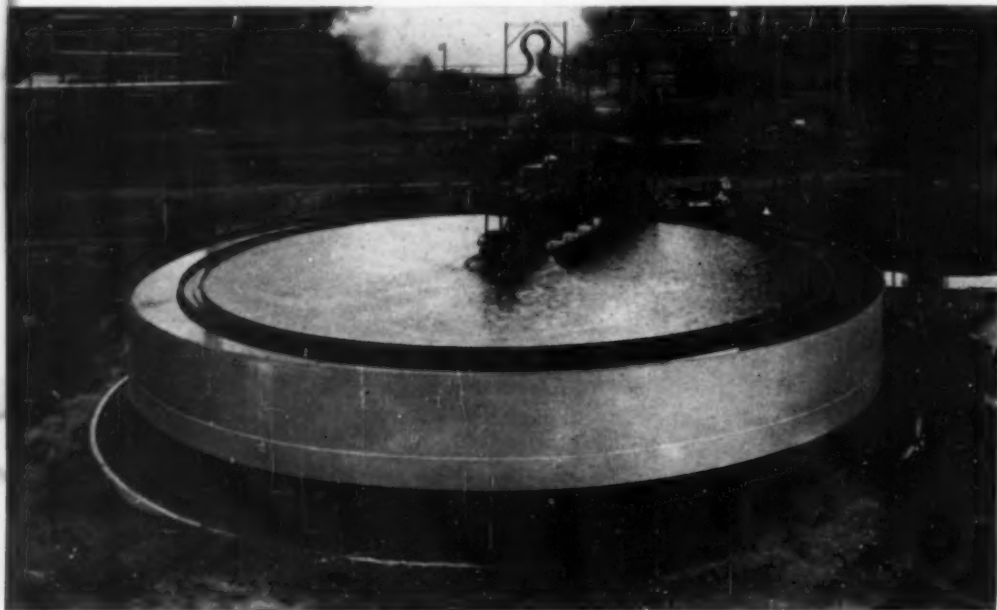
Thickener unit at East St. Louis, Ill.

The coke water slurry is first pumped through a screened basin at the center of the unit. It then passes into the settling basin (inner tank). Coke particles gradually settle on the bottom and are moved gently to a discharge outlet by slowly moving plow blades.

The clarified water overflows from the settling basin into the outer, or surge tank.

The surge tank acts as a reservoir of clarified water that can be used again for cooling or for cutting out more coke from the coking drums.

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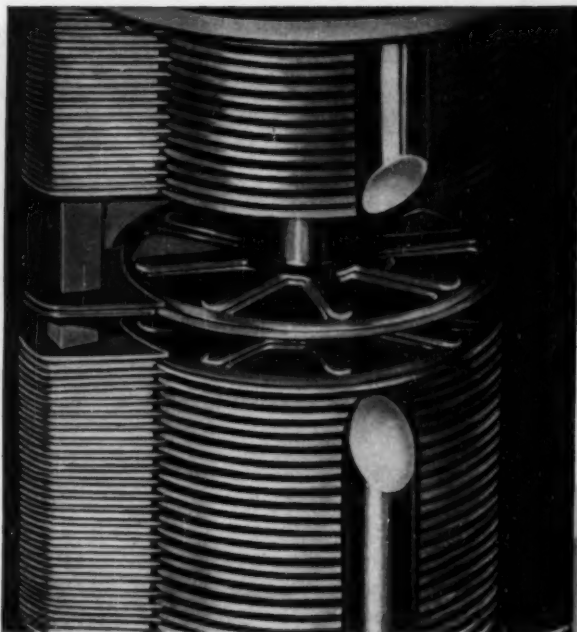
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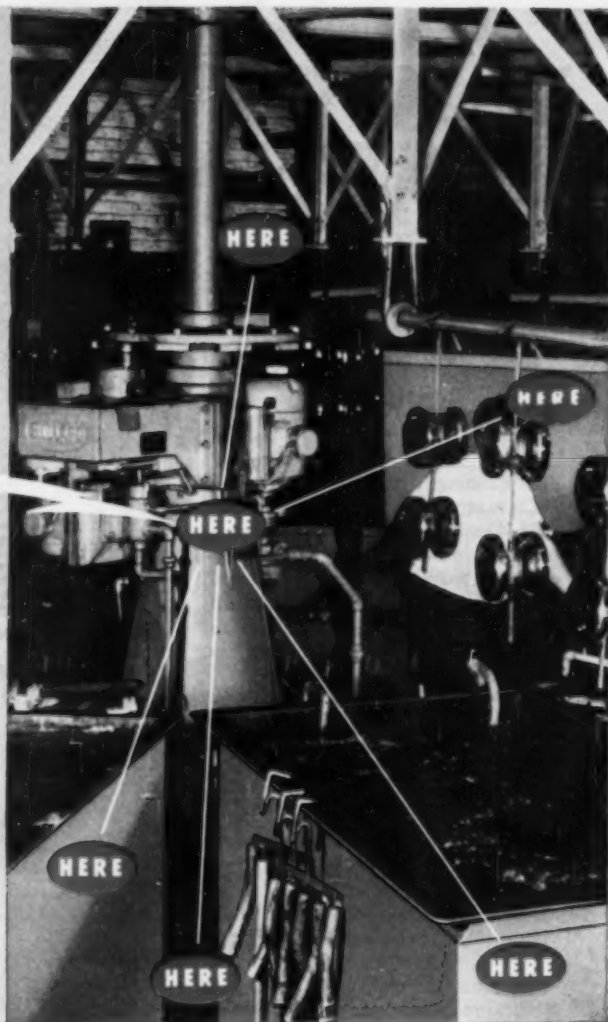


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DEC. 1

THE Chementator

Reg. U. S. Pat. Off.

COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

Sulphur goes under control

The long expected NPA order on sulphur has finally been issued. It takes effect this month. Henceforth suppliers can ship sulphur only when authorized by NPA, and users are limited to 100 percent of last year's rate of consumption.

NPA says M-69 had to be issued because there just isn't enough sulphur to go around. This year, despite a record U.S. output of 5.2 million tons, up two and a half times from prewar production, demand is expected to exceed supply by 1 million tons of sulphur.

Houdriformer for Sun Oil

New Houdriformer, being installed at the Marcus Hook, Pa., refinery of Sun Oil, will produce more than 13 million gallons of benzene and 30 million gallons of toluene yearly. In addition, it will turn out 15 million gallons of aromatic blending stock for aviation gasoline. Completion of construction is expected by fall of 1952.

The unit will take a charge of 11,000 bbl. of low-octane petroleum naphtha daily and convert it by the new catalytic reforming process, developed by Houdry Process Corp., into aromatics. These will be purified by a brand new process, the Sun Arosorb process.

Another way to make phenol

Phenol capacity of Allied's Barrett Division will be trebled by a new \$8 million plant at Philadelphia that will produce about 25 million pounds per year. The cumene-based process that Barrett will use requires no sulphuric acid or chlorine, both scarce and both used in present commercial phenol processes.

Alkylating benzene with propylene gives cumene, which can be oxidized to cumene hydroperoxide. This splits up into acetone and phenol.

Right now, phenol is tight. By year's end, however, new capacity coming in should add about 25 million pounds to estimated 1951 production of 335 million pounds of natural and synthetic. Estimated requirements: 375 million pounds. And by mid-1952 other new production facilities will lift total new production over the present rate by 162 million pounds a year. This should meet growing demands.

Plastics industry takes about 75 percent of all phenol produced. But makers of lubricating oils, rubber, certain medicinals and some insecticides urgently need more phenol immediately to tide them

over until new capacity comes in. Hence NPA will continue to issue DO ratings and directives. No overall allocation program is envisaged yet, however.

Synthetic phenol, which comprises 90 percent of total phenol output, is made from currently scarce benzene. But NPA expects the benzene supply to rise enough to match increased production of phenol.

New objectives for MCA

Now entering its eightieth year, the Manufacturing Chemists' Association is embarking on a broad new program. Close to 500 of the industry's top executives, meeting at White Sulphur Springs, W. Va., voted a 45 percent increase in MCA's annual budget, authorized new plans for expanding the board of directors and rotating directors, and provided more funds for a public relations program, for legal counsel and guidance on over-all and day-to-day problems of the chemical industry.

How mobilization is progressing in the chemical industry and plans for further expansion were reported by William M. Rand. As spokesman for the government, Manly Fleischmann, NPA administrator, lauded the cooperation of the industry, particularly in the loan to NPA and OPS of its top chemical executives.

President Sidney C. Moody of the Synthetic Organic Chemical Manufacturers Association, guest at the MCA meeting, summarized foreign problems besetting chemical manufacturers, especially those arising from the extension of the Trade Agreement Act, the Torquay tariff conferences and pending legislation for customs simplification. All seriously threaten increasing competition from foreign chemicals, particularly from West Germany.

Atomic power for industry

Four industry groups have agreed to explore for AEC the use of atomic energy to produce electric power. Dow has combined with Detroit Edison and Monsanto has teamed up with Union Electric to form two of these groups.

What these teams will undertake for AEC is a study, financed by the companies and lasting not more than one year, on the feasibility of a nuclear reactor for making plutonium and power simultaneously. If they succeed, this would be the first step in a program, first proposed by President Charles A. Thomas of Monsanto, that could, in a minimum of three and a

(Continued on page 72)

THE CHEMENTATOR, continued

half years, see industry making plutonium for the government and, at the same time, producing power for private use.

Second step, according to Thomas, would be a contract with AEC to build such a plant. Its cost would be from \$50 million to \$100 million, to be written off over 10 years. A supply of uranium would have to be insured over a 10-year period. Third step would be for the company to operate the plant.

Cheaper plutonium and low-cost electricity for areas where its production by other means would be too expensive are the twin goals envisioned by Thomas. "We're interested in the program," he says, "because (1) it's good for the country and (2) we have deposits of ore in Idaho, without power facilities for processing to turn out phosphorus."

More electrodes needed

Carbon electrodes and artificial graphite products will be allocated by NPA, starting this month. Growing shortages of graphite and carbon electrodes threaten the government's program for expanding production of magnesium and aluminum, urgently needed to make military aircraft. Demand for graphite by atomic plants is extremely high. Makers of sodium, calcium carbide, phosphorus and other critical chemicals must get electrodes for electrolytic cells and electric furnaces.

About 200 million pounds of artificial graphite and carbon electrodes are produced annually by four companies. This production goes to 1,265 consumers, the biggest users being operators of electric furnaces.

To smash this roadblock in the way of defense production, NPA is authorizing new plants and added capacity. National Carbon will build a \$16,359,600 plant. Great Lakes Carbon will spend \$183,000 at Morganton, N. C., and International Graphite & Electrode Corp. will put up an \$11,073,100 plant at Niagara Falls. All these projects are certified for 75 percent on fast tax writeoff. Their object: to boost production of carbon and graphite electrodes.

Can phthalic output keep pace?

Filling defense orders is getting to be a tough job for makers of phthalic anhydride. They want NPA to limit the DO orders they have to fill to a percentage of their output. NPA may also give them a break by requiring a lead time on all defense orders for phthalic anhydride. Both actions are possible under M-32.

It's estimated that 261 million pounds of phthalic anhydride will be required this year. And by 1953 total demand will reach 348.6 million pounds.

To keep pace with these demands, eight projects are now under construction or are being planned. By 1953, these additions to capacity will expand total production to an estimated 373.4 million pounds—a

margin of 24.8 million pounds above expected requirements.

Skyrocketing output of alkyds and of plasticizers accounts for most of the rising demand for phthalic anhydride. It's also needed for dyestuffs, insecticides and smokeless powder.

Phthalic anhydride is made from naphthalene or ortho xylene. Getting enough naphthalene isn't going to be easy. This year's supply of 378 million pounds will fall short of meeting all needs by 26.7 million pounds. And by 1953 expected requirements will exceed estimated supply by 96.3 million pounds. To offset this, consideration is being given to increasing naphthalene production facilities beyond those already planned.

Nitric acid from the atmosphere

Thermal fixation of nitrogen that leads directly to nitric acid will at last get a full-plant trial. Food Machinery & Chemical Corp. is installing equipment at Lawrence, Kan., in the former Sunflower Ordnance Plant.

The process, developed by the University of Wisconsin and Food Machinery, involves oxidation of nitrogen in a regenerative furnace (for details, see *Chementator*, June 1949, p. 70). Best of all, it goes directly to nitric acid, bypassing the oxidation of ammonia.

Output of this plant will help meet demand of the U.S. Department of Agriculture for a yearly increase of 200,000 tons or more of fixed nitrogen production. One headache for planners: inability of the military to pinpoint their future nitrogen needs.

Anhydrous ammonia invades East

Anhydrous ammonia for direct application to crops in the soil will be distributed to farmers of the Eastern Seaboard by Suburban Propane Gas Corp. This move dovetails with Suburban's distribution of liquefied petroleum gas. Much of the equipment for handling ammonia, such as storage tanks and pumps, is similar to that used in propane distribution.

Three bulk storage plants at Berlin, N. J., Delmar, Md., and Keller, Va., are now near completion. Each will service an area about 40 mi. in radius. At Suburban's proposed price the cost to the farmer will be 15 c. per lb. of nitrogen, compared with 16 c. to 19 c. per lb. for dry fertilizers.

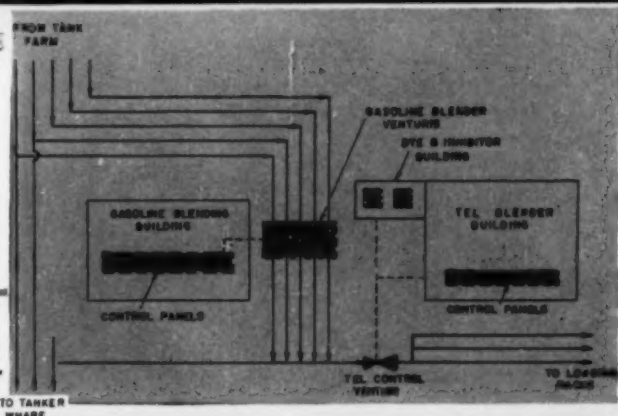
Anhydrous ammonia has an important role to play in Eastern Seaboard agriculture. One experiment at Morrisville, Pa., showed that use of liquid ammonia at the rate of 76 lb. per acre raised the yield of spinach per acre about 60 percent, from 10,735 lb. to 17,176 lb. Another in New Jersey showed that 122 lb. of ammonia applied to corn lifted output from 26 bu. to 107 bu. per acre.

Fanning out from Mississippi, use of anhydrous

(Continued on page 76)

Blueprint

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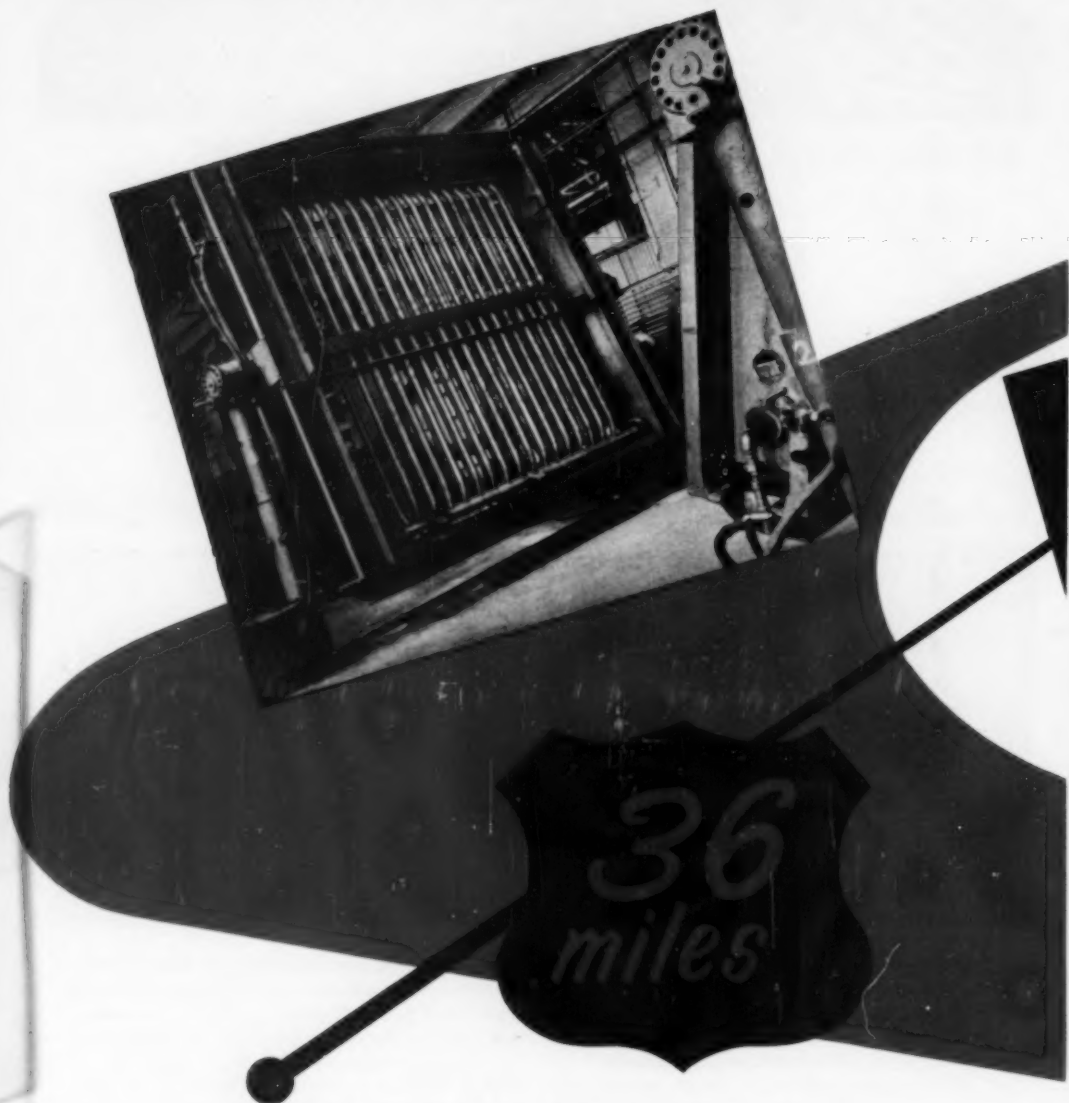
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CHEMICAL ENGINEERING—July 1951

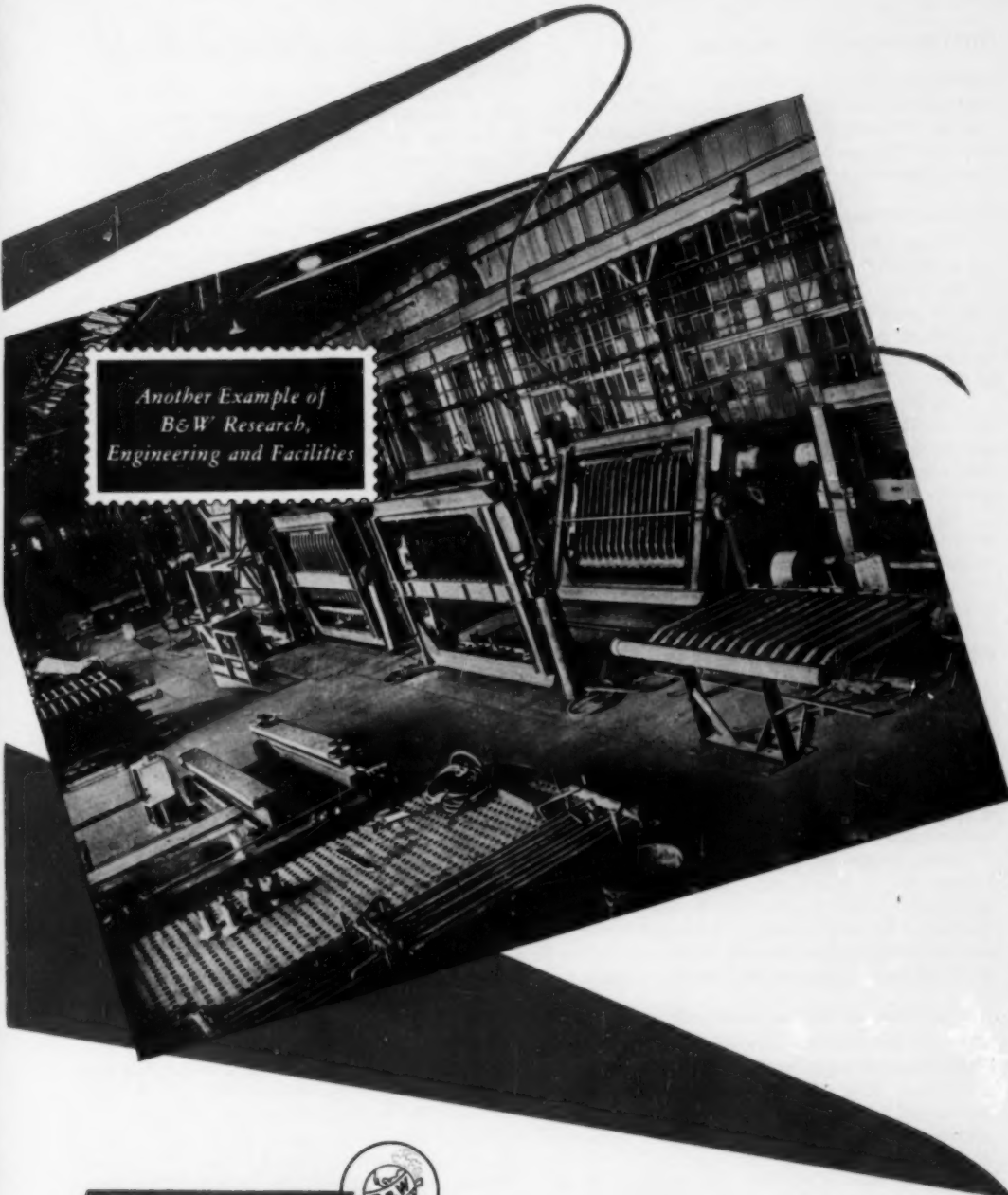
73



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THE CHEMENTATOR, continued

ammonia has spread into the rest of the South and other parts of the country. From 1941 to 1947, while total use of fertilizers increased by 106 percent, use of ammonia fertilizers leaped 273 percent. And now anhydrous ammonia is primed for its invasion of the East.

Chlorine without caustic

Solvay will expand its Hopewell, Va., plant to get an added 28 tons a day of chlorine without producing caustic. That's a 50 percent boost in the plant's chlorine capacity. The \$2.15 million unit, for which a certificate of necessity has been granted, will convert nitrosyl chloride from the present chlorine plant to chlorine. It will take two years to build.

Solvay's original plant at Hopewell, completed in 1936 and doubled in capacity in 1942, converts salt and nitric acid to sodium nitrate and chlorine, with nitrosyl chloride (containing 4-10 percent nitrogen tetroxide) as byproduct.

Up to now, much of the nitrosyl chloride has been absorbed in sodium carbonate solution to recover sodium nitrite. Another portion has been recycled to the system, and part recovered for use in making a synthetic detergent (by reacting the nitrosyl chloride with a long-chain olefin fraction and combining the product, a nitroso chloride, with sodium bisulphite).

Now, the nitrosyl chloride hitherto recycled will be used to make chlorine by an oxidation process. Nitrosyl chloride vapor will be contacted with oxygen to produce nitrogen tetroxide and chlorine, both of which are then cooled to liquefy them. After liquefaction, chlorine is distilled out. The nitrogen tetroxide is absorbed in water to make further nitric acid for reaction with more salt.

Best thing about this process is that it produces chlorine but no caustic soda. But there's a limit on the amount of chlorine that can be made this way—the market for sodium nitrate. Barring an unforeseen increase in demand for sodium nitrate, not too much more chlorine can be made from nitrosyl chloride.

Are we making enough soda ash?

NO CERTIFICATES NOW—NPA may not grant certificates of necessity for increasing soda ash capacity at this time. That's the word that seven alkali industry representatives got at a recent Washington powwow presided over by Kenneth H. Klipstein, director of NPA's Chemical Division.

SODA ASH—U.S. soda ash capacity is now roughly 4.5 million tons a year, according to NPA, which thinks that's ample for current requirements. Actually, ash capacity is probably hovering at a shade higher than 5 million tons. Projecting needs as far as 1953, NPA estimates that only 5.5 million tons will be needed then. Alkali spokesmen aren't so sure that it won't be 6 million tons or more by then, especially

since the big expansion in aluminum production will take so much ash.

CAUSTIC—NPA also points out that of the 2.5 million tons of caustic soda currently produced, 2.25 million tons are consumed yearly. Caustic capacity is probably close to 3 million tons a year, and consumption nearer to 2.4 million tons.

SWITCHOVER—Today, most caustic is produced electrolytically. But some lime-soda caustic is still made. If plants now using soda ash to make lime-soda caustic discontinued caustic production, they could add to the output of soda ash. NPA may be counting on this. Even so, alkali makers urge NPA to make a geographic survey of production facilities first. They point out that for economic reasons this switchover from lime-soda caustic to soda ash production isn't possible in certain locations.

More sulphur from sour gas

Sulphur will be recovered from sour gas at the rate of 125 tons per day in a recovery plant that Phillips Chemical Co. will build near Goldsmith, Tex. The sulphur will be shipped to the Fort Worth plant of Consolidated Chemical Industries for conversion into sulphuric acid, which in turn will be transported to the Pasadena, Tex., plant of Phillips, where it will be used to make ammonium sulphate.

This is the second sulphur extraction unit announced for the area around Odessa, Tex. Odessa Natural Gasoline Co. and Sid Richardson Carbon Co. will build a \$200,000 sulphur recovery plant near Odessa, where the former company operates a gasoline plant.

Also shaping up are plans for a sulphur extraction unit near Emory, Tex., where deep sulphur-rich gas has been developed. Lion Oil Co. is interested in this project.

Golden crescent for chemicals

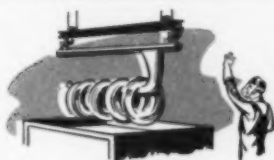
A new and even greater golden age is dawning for the chemical industry in the lush Gulf Coast of Texas, that 100-mi. deep belt arcing from Lake Charles, La., to Brownsville, Tex. Already, investment in chemical plants and equipment there is teetering around the \$1 billion mark, will go even higher.

Total value of chemical plants in the Gulf Coast area at the beginning of this year is estimated at \$750 million by Dr. Frederick A. Buechel, Houston research economist who has just surveyed the region's expanding chemical industry. What's more, 16 companies will pump \$100 million into the Gulf Coast during 1951 and 1952 for plant expansion.

And that's not counting construction or expansion of plants such as those of Shell, Carthage Hydrocol and Ethyl Corp., which will add another \$80 million chunk. Nor does it include investment in some related industries—the \$80 million Reynolds Metal plant now

(Continued on page 78)

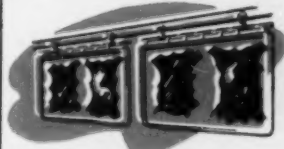
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THE CHEMENTATOR, continued

building at Corpus Christi, nor Alcoa's \$15 million expansion at Port Lavaca. Moreover, other big chemical construction projects along the Texas Gulf Coast await only NPA clearance to get going.

Average investment per worker in the chemical plants of the Gulf Coast is \$30,000, with the number of workers totaling nearly 26,000. Total monthly payroll is almost \$9 million, with the average income per worker being nearly \$350.

Focal point of this expanding chemical frontier is Houston. During the past decade it has climbed from twenty-first to fourteenth among U.S. cities in population. Its metropolitan area has more than 810,000.

Solvay adds to ammonia capacity

Solvay will increase its synthetic nitrogen capacity by 100,000 tons per year, converting at the same time from coke to natural gas as a source of hydrogen. The expansion will take place during the next two years at Solvay's Hopewell, Va., and South Point, Ohio, plants. Total cost: over \$25 million.

This will be an expansion on top of an expansion. Since 1946, aggregate annual capacity of the Hopewell and South Point plants has been expanded by 80,000 tons of nitrogen.

During the past 10 years the use of ammonia has about tripled. Today, total U.S. capacity for synthetic ammonia is about 1.4 million tons of nitrogen annually, with an added 400,000 tons contemplated.

Mixed fertilizer consumption in the Midwest farm belt alone has increased 500 percent in the last 10 years. This big increase in consumption has been met almost entirely from synthetic sources.

Another phosphorus producer for the West

Monsanto will build a multi-million dollar plant near Soda Springs, Idaho, to produce elemental phosphorus. One electric furnace will be put up at first, but others will be added. First production is expected late next year.

Decision to build the plant came after a three-year investigation of phosphate rock deposits, plant sites, power and transportation facilities in the area.

International to acquire Innis, Speiden

Acquisition of Innis, Speiden & Co., old-line U.S. potash chemical company founded in 1816, by International Minerals & Chemical Corp. can be expected.

Board of directors put this plan before stockholders of International at a special meeting in New York: (1) increase authorized shares of International common stock, par value \$5 per share, from 2 million to 2.5 million shares; and (2) acquire all assets of Innis, Speiden in exchange for 76,648 shares of the new International common.

Innis, Speiden manufactures, refines or processes caustic potash, carbonated potash, chlorine and chlorinated minerals and chemicals, and industrial waxes and gums. It operates a manufacturing plant at Niagara Falls, N. Y., a refining and processing plant in Jersey City, N. J., and a warehouse in Chicago, Ill.

Potassium chemicals are important industrial chemicals, manufactured from muriate of potash, one of the principal products of International Minerals. Hence the business of Innis, Speiden forms a natural basis for further expansion of International.

Resorcinol: still more capacity

Added starter in the race to boost resorcinol production is Koppers, currently the biggest producer. Koppers will increase the output of its Petrolia, Pa., plant, pioneer resorcinol unit in the U.S. and still the largest, from 4.5 million pounds to 6 million pounds a year. A new process will account for part of the capacity increase. Every effort will be made to get the new facilities into operation by November.


When all current expansions are completed output of resorcinol will reach 8 million pounds annually. Present production is 4.8 million pounds, with Koppers making 4.5 million and Heyden 300,000 pounds a year. Heyden is doubling capacity of its Garfield, N. J., plant to 600,000 pounds, will then raise that to 1 million pounds. And Borden is building a plant at Tacoma, Wash., first on the West Coast, that will turn out 1 million pounds a year.

Enough resorcinol should be available as a result of these additions to capacity, hopes Vice President Dan M. Rugg of the Chemical Division of Koppers, to continue its use in dyestuffs during the present emergency when rubber and adhesive demands are taking the biggest bite. Resorcinol is now under government control, and NPA will allocate the entire production of these expanded plants, which will also gobble up benzene as raw material.

Pinch bitter for styrene

When you need styrene but can't get the benzene to make all you need, what do you do? Dow Chemical Co. has one answer: you make vinyl toluene, which is methyl styrene, instead. Vinyl toluene can pinch hit for styrene in many uses, and it's made from toluene, not as hard to get as benzene. Dow hopes to be producing vinyl toluene in a new plant at Midland, Mich., by July 1952. Its cost: over \$10 million.

Not too much will be made, however, since a vinyl toluene plant costs more than a styrene plant per pound of product. Separating the ortho from the mixture of meta and para isomers runs the cost of a vinyl toluene plant up. Even so, the new plant will help relieve the painful pinch in styrene. Much of its output will go into styrenated alkyd coatings. The government alone expects this year to use about 5 million gallons of paints containing these alkyds. —End



Insecticide-dusting
the modern way.

INSECTICIDES...

one of many uses for **CHLORINE**

Chlorine is an essential component of many insecticides and weed killers. But it is also in heavy demand for other important uses. To its direct applications as a bleach and as a sanitizing agent are added its constantly expanding use in the manufacture of pharmaceuticals — anti-freeze — chlorinated hydrocarbons for solvents and refrigerants — synthetic glycerine — chlorinated styrene and polyvinyl chlorides for plastics and rubber.

Matching chlorine production with demand is particularly difficult in times like these. Mathieson is increasing its production facilities to provide this basic chemical and many of its derivatives on a broad scale. Consult Mathieson — possibly a program to meet your future needs can be arranged. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

Mathieson
CHEMICALS

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

CHEMICAL ENGINEERING—July 1951

79

DAVISON

Finely-Sized Synthetic Silicas

—as small as .5 micron diameter (.5 μ)

for products or processes requiring high-purity
non-crystalline silica

DAVISON has the experience and knowledge to chemically control silica gel production for precise uniformity of structure. Such silica gel characteristics as pore size, density and internal surface area are altered to assure maximum benefits in your application.

If you need a finely-sized, non-crystalline synthetic silica of high purity, write for information, specifications and samples of Davison silica gel. We will be happy to give you our recommendations based on experience and research. Mention your proposed application when writing.

Properties: HIGH PURITY • CHEMICALLY AND PHYSICALLY INERT • CONTROLLED ADSORPTIVE CAPACITY •
CONTROLLED DENSITY • FREE FLOWING • SURFACE AREAS UP TO 1000 SQUARE METERS PER GRAM

Typical Uses: ANTI-CAKING AGENT IN DYES, CHEMICALS, FOODS, PHARMACEUTICALS • DECOLORIZATION
OF ORGANIC COMPOUNDS • PIGMENT EXTENDERS AND FLATTING AGENTS • DEHYDRATING AGENT IN ALUMINUM
PAINT • INSECTICIDE DILUENTS • INCREASING POROSITY OF MEDICINAL TABLETS • SELECTIVE SEPARATION
OF PHARMACEUTICALS AND HYDROCARBONS

TYPICAL ANALYSIS ON DRY BASIS 99.71% PURE SiO_2 : Where cost of materials is a primary factor and constituent compounds will not affect your process, Davison silica gel can be supplied in less pure form. The material is also available in greater degrees of purity for extremely sensitive processes.

Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLOURIDES AND FERTILIZERS

Century SELECTIVE SPEED *Drives*

Permit Exact Speed Control for Increased Production • Better Quality Control

Here are a few typical applications

that demonstrate the benefits which you can get from Century Selective Speed Drives on either new equipment or your present set-up.



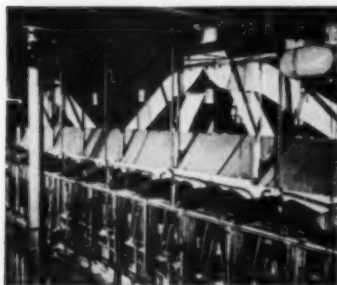
Production increased, machining quality was improved, accuracy is held closer and set-up time is reduced as a result of achieving optimum peripheral cutting speeds on this boring mill.



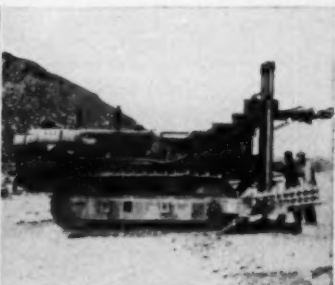
Costs are cut and scrap is reduced because maximum speeds are easily controlled for different classes of work done on this printing press. Accurate control maintains exact register of multiple copy forms.



Better quality control is maintained over production of latex threads because of the wide selection of speeds plus smooth acceleration and deceleration. Extreme flexibility permits fast change-over when a new gauge, or size, of rubber thread is to be produced. Instant stopping is also an important protective feature.



Uncoilers and coilers with pinch rolls and looping device, require a wide range of inter-related automatic sensitive speed changes. As the coils of material unwind from one spool and wind on another spool, the diameters change yet the speed through the electrolytic process must be at a constant rate.



Operating speeds are instantly controlled on this earth auger drill rig. Permits operator to change speeds according to the type of earth being drilled. Drilling is done to depths of 100 feet in strip mining.



CENTURY ELECTRIC CO.

1806 Pine St. • St. Louis 3, Missouri
Offices and Stock Points in
Principal Cities

Century Electric Company is celebrating its 50th year in the electrical industry

BAKER PLATINUM LABORATORY WARE



No more exacting tests could be applied to any product than those to which our platinum laboratory ware is subjected. The tests are continuous, because we maintain and operate large scientific laboratories and naturally employ our own laboratory ware in them.

The consequence is that any divergence from our high standards, any defect in manufacture, would show up inevitably.

All this makes it doubly safe for you to adopt Baker Laboratory Ware as standard equipment. You can't possibly go wrong in choosing it.

BAKER & CO., INC.

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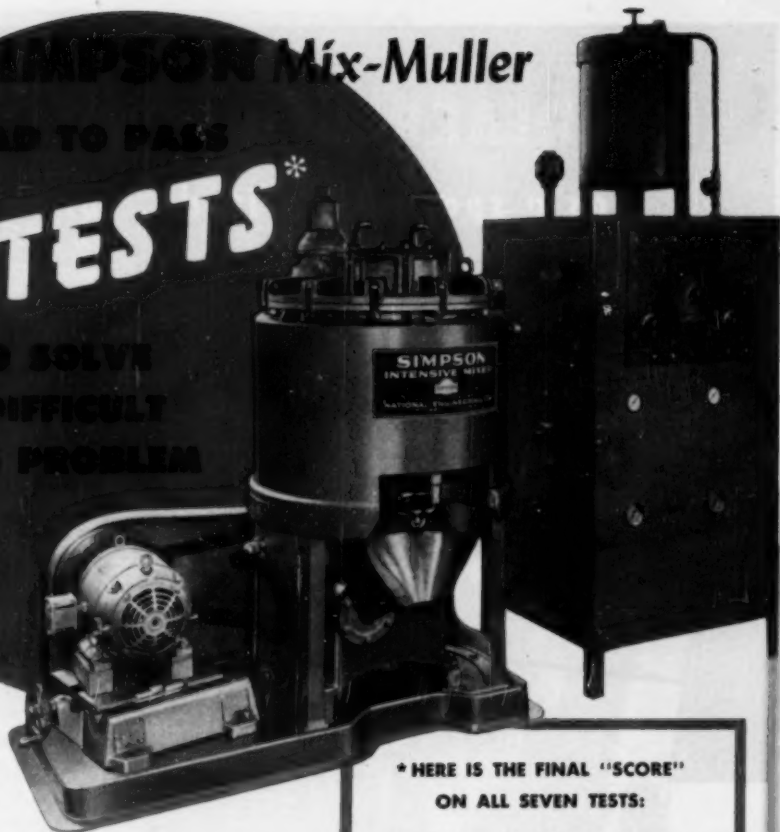
This SIMPSON Mix-Muller

HAD TO PASS

7 TESTS*

TO SOLVE
A DIFFICULT
MIXING PROBLEM

*Specially-designed
Simpson Mix-Muller
built for experi-
mental processing
work in a large
eastern plant.*



YOUR particular mixing problem may not be as complex as the one which required the 7-point solution outlined here. But no matter what your requirements may be—there is a Simpson Mix-Muller qualified to handle the job, in 10 different models, with capacities from 1/10 to 30 cubic feet per batch.

All of these models offer the proven *intensive mulling* principle of controlled mixing, to blend all types of dry, semi-dry and pasty materials better, faster, and at lower cost. These modern Mix-Mullers are also available with all necessary equipment for use as reaction vessels, where reactions, heating, cooling, pressure or vacuum can be scientifically controlled.

Write today for details on the complete line of Simpson Intensive Mix-Mullers.



* HERE IS THE FINAL "SCORE" ON ALL SEVEN TESTS:

- | | | |
|---|--|----|
| 1 | Provide a complete "packaged" mixer in a small, compact unit suitable for laboratory or pilot plant use. | OK |
| 2 | Must have variable speed drive for all conditions. | OK |
| 3 | Must be completely jacketed for hot oil circulation. | OK |
| 4 | Provide both vacuum and pressure operation, for use as a reaction vessel. | OK |
| 5 | Provide complete, compact oil heating unit as part of mixer installation. | OK |
| 6 | Provide complete electric installation . . . explosion-proof motor, starter and light socket. | OK |
| 7 | Must have all stainless steel parts within mixing chamber for high corrosion resistance. | OK |

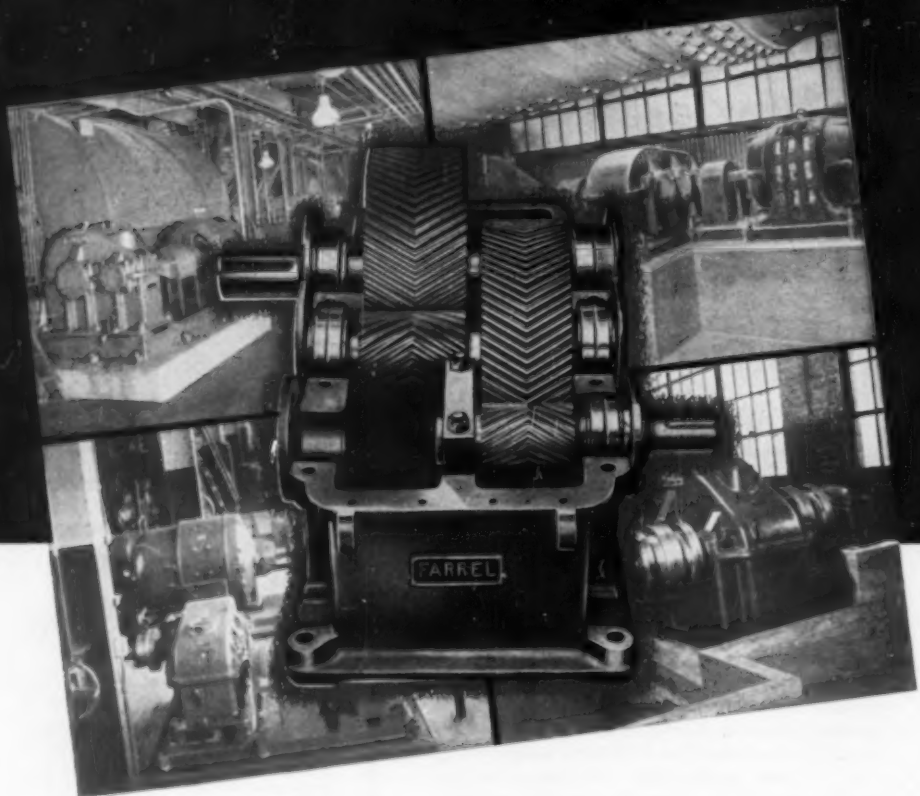
SIMPSON Mix-Muller* Division

NATIONAL ENGINEERING CO. 444 Madison Mall Bldg. Chicago 6, Ill.



EACH FARREL SPEED REDUCER

has a special "aptitude" for its job



The design of Farrel speed reducers permits an engineering freedom in proportioning gears, shafts, bearings and even some housing dimensions to meet specific load, speed and service requirements. This flexibility has resulted in the solution of innumerable application problems.

In addition to this feature, Farrel speed reducers have a number of other advantages which help to account for their "aptitude" in handling tough assignments. The quiet, vibration-free performance of the herringbone gears results from extreme accuracy of tooth spacing, contour and helix angle . . . qualities inherent in the Farrel-Sykes method of gear gen-

eration. Precision manufacture and highest grade materials contribute to long gear life.

Shafts and bearings are factored to safeguard against interruption of vital processes. Gear cases are proportioned to withstand repeated heavy peak loads. Joints are sealed to prevent entrance of dirt.

Write for further details of these *problem-solving* units. Ask for a copy of Bulletin 449.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Cleveland, Detroit, Chicago, Portland (Oregon), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

Farrel-Birmingham®



HOW A SMALLER FEinc FILTER

...Does a Bigger Job!

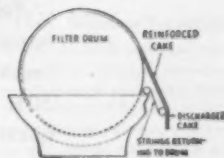
Because it does away with costly slow-downs due to filter cloth blinding—and eliminates stoppages necessary to change cloth that's worn out by a scraper—the FEinc continuous (really continuous) rotary vacuum filter gives higher filtration rates per square foot with less maintenance—and that's what counts! For instance, these actual cases:

Two scraper-type filters handling black iron oxide ran partially blinded. The resulting mud was wet, due to the heavy blow-back which returned some filtrate to the cake in attempting to free the fine solids. The same job is now handled on just one FEinc, with no plugging, and dry cake.

Zinc oxide formerly came off a scraper filter so wet it had to be shoveled onto an intermediate drum dryer. Now a FEinc string filter eliminates the intermediate dryer, drops cake directly onto the final dryer's conveyor.

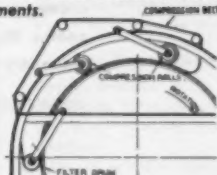
A porcelain plant reported costs reduced 59% by one FEinc continuous filter producing cake with uniform 17% moisture, as compared with four plate-frame presses formerly used.

Lighter, more efficient fabrics last longer on the FEinc String Filter, give you clearer filtrate, lower loss of solids. Then too, the FEinc compression mechanism removes 2-6% more moisture, and the FEinc submergence washing mechanism washes cakes down to unbelievable purity. Any combination of FEinc features can be engineered to your needs at reasonable cost. Ask for Bulletin 103.



Note how the FEinc String Discharge reinforces the filter cake and removes it from the filter drum in one continuous, easy-to-handle sheet.

FEinc compression mechanism, consisting of belt and rolls, gets more moisture out of cake than vacuum could do alone. Rolls seal cracks in cake which reduces vacuum requirements.



FILTRATION ENGINEERS INC.
155 ORATON STREET • NEWARK 4, NEW JERSEY

PROBLEM...

...to help foundries speed up the production of castings for critical defense and civilian needs.

SOLUTION...

...Truline® Binder and NVX—two low-cost Hercules materials for bonding foundry sands. Truline accelerates core-baking, gives stronger-handling, more uniform cores. Hercules® NVX improves flowability and workability of green sand facing, gives better molds and castings.

Resin Chemistry Sets

RESULT...

...Foundry sands that are more quickly and accurately formed into molds, and produce sounder, truer castings that require less finishing. Cleaning time has been cut as much as 50% with Truline-bonded cores because they burn out quickly, collapse easily, and shake out fast. Foundries everywhere today benefit from the higher production speeds and greater economy of Truline Binder and NVX.

Other Hercules developments in resin chemistry are helping to set the production pace in many industries. For example, Vinsol® Resin—as the air-entraining agent in Portland cement—produces more durable highways, bridges, airport runways. This readily available material also alleviates materials shortages and improves performance for adhesives, plastics, paper. Hercules welcomes the opportunity of placing its long experience in resin chemistry at your disposal.

HERCULES POWDER COMPANY 952 Market St., Wilmington, Delaware

Sales Offices in Principal Cities

HERCULES



SYNTHETIC RESINS—CELLULOSE PRODUCTS—TERPENE CHEMICALS—ROSIN AND ROSIN DERIVATIVES—CHLORINATED PRODUCTS—OTHER CHEMICAL MATERIALS FOR INDUSTRY



The Pace



Let Lacquer Do It

A new Hercules leaflet, "Some Facts You Should Know About Lacquer," gives reasons for the ready availability and usefulness of lacquer today.

The leaflet points out that nitrocellulose lacquer is the least vulnerable to shortages of all production-line finishes today. Basically, the reasons for its availability are: ample production capacity for both nitrocellulose and lacquers to take care of military and essential civilian demands; lacquer formulations that are so flexible that lacquer is not tied to any one critical material, or to any group of materials.

The use of the hot-spray process is also recommended, wherever possible, in order to conserve solvents as well as to save production manhours.

Modern lacquer formulations, hot or cold, will be considered for military applications even where synthetic enamels are now specified because of the better availability of lacquers and the possible advantages obtainable by hot-spray, according to the leaflet, which also lists a number of military uses for which lacquer is now specified.

Non Phthalate Plasticizer

Phthalic anhydride shortages need no longer mean plasticizer shortages for manufacturers of vinyl goods. Commercial production of Hercoflex® 600, the new non-phthalate primary plasticizer for vinyl chloride polymers and copolymers, has just been begun after over three years of customer evaluation. Although initial production remains limited until expanded facilities are available, this new monomeric plasticizer provides, for the first time, a product competitive in price and performance with conventional phthalates but based on noncritical raw materials. Hercoflex 600 offers excellent heat and light stability, exceptionally low volatility, and good low temperature properties and plasticizing efficiency. Samples and literature will be supplied on request.

New Resin Dispersion

Hercules Dresinol® 155, a new non-solvent-type, high-melting resin dispersion, is now available in commercial quantities.

This new resin dispersion can be used as a modifier and extender for synthetic or natural rubber latices in adhesives, supported films, and binders of all types. It is completely compatible with all types of latices.

QC51-4

IN OLD FORESTER'S KENTUCKY HOME

as in so many of industry's most
efficiently operated buildings

Jenkins Valves
are standard

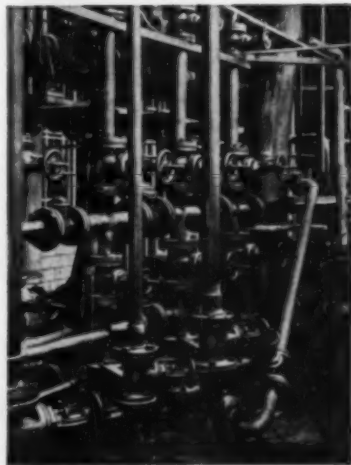


With science and skill, Brown-Forman Distillers Corporation carries on a famous Kentucky tradition of fine whisky. To insure uniform fineness in the flavor of Old Forester and its other whiskies, nothing is left to chance in the Brown-Forman distilling operations at Louisville.

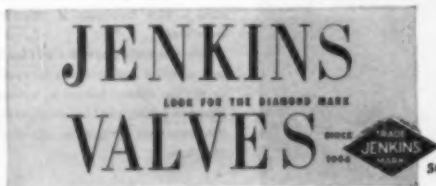
Equipment for control of production is checked with the same meticulous care as grain samples, before approval. It is significant that Jenkins Valves, standard for years in all Brown-Forman distilleries, were again specified when plant facilities were expanded and modernized recently.

Significant, but not unusual. Jenkins Valves have been the choice *consistently* of the men who plan America's outstanding buildings. Future-minded, these men — architects, engineers, contractors — think of all operating equipment in terms of tomorrow's maintenance costs.

Jenkins builds *extra* endurance into valves — proved by low upkeep cost records in every type of service. Yet, despite this extra value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.



Among more than 3500 Jenkins Valves in Brown-Forman's Louisville plant are these which control the flow patterns through quadruple effect evaporators in the By-Products Building

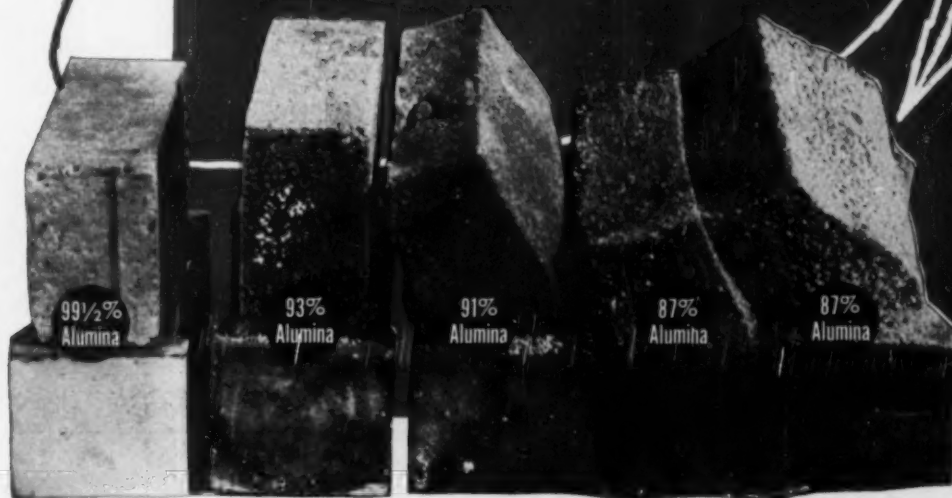


SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

Jenkins Bros.

Down time costs more

than good refractories



Modern operators are using refractories fortified with ALCOA Alumina to increase the output of their metallurgical furnaces, chemical processing kilns, glass tanks and other high-temperature equipment. They know that down time costs more than good refractories, and refractories fortified with ALCOA Alumina *considerably reduce down time!*

The increased stability and high-temperature resistance provided by ALCOA Alumina is clearly shown in the specimens illustrated above. All are alumina-content brick, and all were held at a temperature of 3400° F. (Cone 40, flat) for four hours. From left to right, the alumina content of each brick is: 99½%, 93%, 91%, 87% and 87%. You can see how important even a little extra ALCOA Alumina is to the life of a refractory.

(Photo and data: Richard C. Remmey Son Co.)

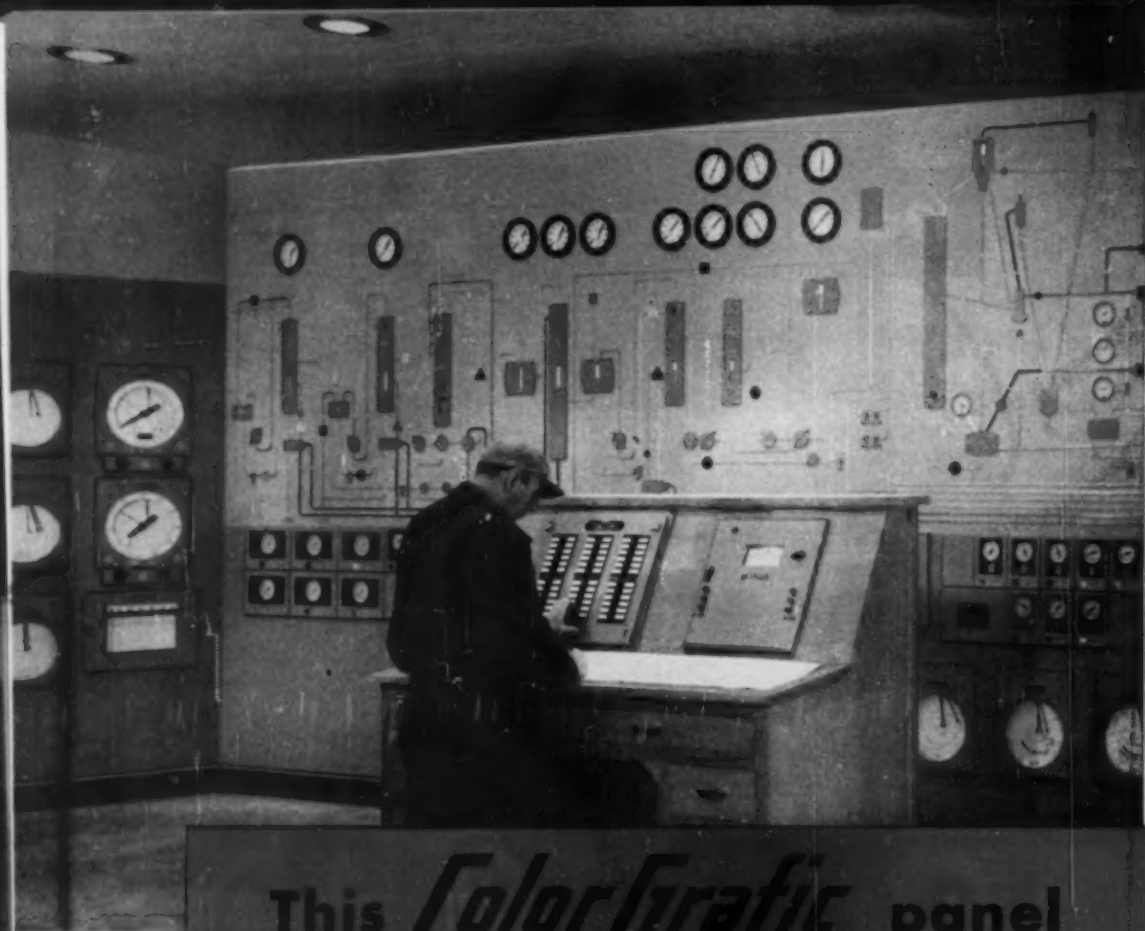
Whatever your operating temperatures, you'll have less costly down time as a result of too-frequent refractory replacement, when you use alumina refractories. They provide strength and stability under load at high temperatures . . . resistance to spalling, abrasion and fluxing . . . resistance to corrosive slags and gases . . . negligible porosity and shrinkage. We'll gladly refer you to reputable manufacturers of high-alumina refractories. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 602C Gulf Building, Pittsburgh 19, Pennsylvania.

Alcoa Chemicals



ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODIUM ALUMINAS
ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM
ACID FLUORIDE • FLUORINIC ACID • CRYOLITE • GALLIUM



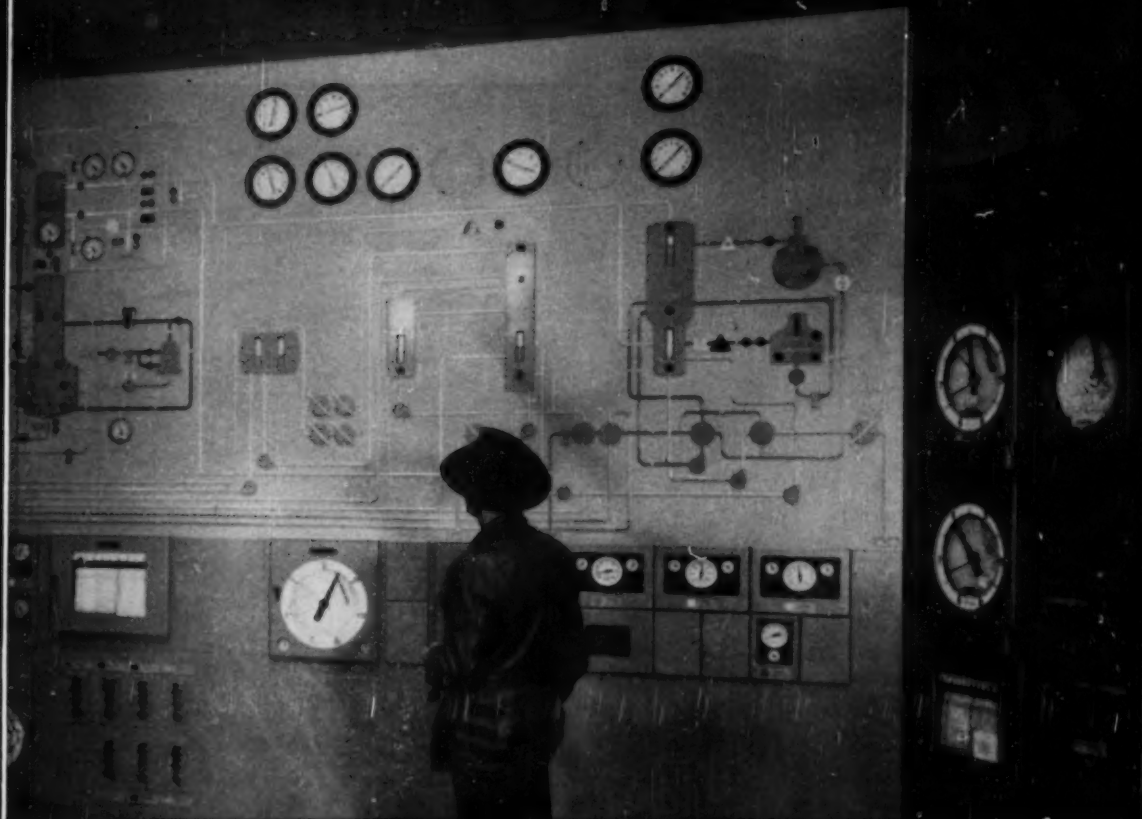
This *Color Graphic* panel

THIS new Brown *Color Graphic* Panel at the Great Lakes Refinery of Petco Corporation dramatically illustrates, in panoramic style, all symbols and flow lines of four complete processes. The details of Houdriflow*, polymerization, gas recovery and feed preparation are easily followed and controlled. Twelve different colors are used to indicate such flows as high pressure condensate, re-

actor charge and gasoline, product gas, air, catalyst, and others.

This consolidated control of the four processes lowers operating expenses . . . increases operator convenience . . . and reduces training time for personnel, even when the trainee has little or no previous knowledge of the process being controlled.

*Constructed by Catalytic Construction Company, Philadelphia, Pa.



spotlights multi-process control

Such instrumentation permits the separation of recording and controlling functions—thereby, affords the opportunity to utilize improved mechanisms like the Brown mercuryless Differential Converter. Space is saved through smaller control areas. Installation is easy . . . start-up is simplified.

Vol. 5 No. 3 of **INSTRUMENTATION** contains a detailed description of this installation. Write for a copy . . . and for folder No. 228-1 on *Color Graphic Panels*.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, 4478 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell

Brown Instruments

**Totally-Enclosed
Fan-Cooled
MOTORS**

GET THE MOTOR that Cleans Itself

DROP MOTOR MAINTENANCE COSTS to a new low by reducing motor cleaning operations. And this new Allis-Chalmers Type APZ tefc motor makes maintenance costs lower than ever before on this type of motor.

Here's Why

Concealed air passages and pockets have been eliminated; dirt cannot build up to cause overheating. Cooling air is blown over the ribbed cast iron frame and bearing housings carrying dirt away with it. How about oily dirt that sticks? It can be wiped or blown off without stopping the motor.

Rigid Construction

The frame is of rigid cast iron which

not only has high inherent corrosion resistance, but also holds bearings in alignment. Bearings are prelubricated at the factory and should need no attention for years. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are standard equipment.

Get All The Facts

The new Allis-Chalmers Type APZ totally-enclosed fan-cooled chemical motor is built in all NEMA standard frame sizes from 224* to 505. Also in explosion-proof type.

Your A-C Authorized Dealer or District Office has complete information. Call today, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B6144.

A-3397

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS



Sold . . . Applied . . . Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.



TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



PUMPS — Integral motor and coupled types from 1/2 in. to 72 in. discharge and up.

*Similar design non-ventilated motors Type APK, also available in frames 203 to 224 inclusive.

THESE
Metallic Ricinoleates
SHOW PROMISE OF
Stepped-Up Performance
IN MANY FIELDS

New Metallic Soaps

High potential usefulness in a wide range of applications is indicated for these new metallic soaps by current studies. They have shown parallel or better performance compared with metallic stearates and are highly recommended for any of the following:

Adhesives
Anti-corrosive
agents
Concrete
Cosmetics
Emulsions
Greases
Inks
Lacquers
Lubricants
Oils

Plastics
Protective
coatings
Rubber
Suspensions
Varnish
Vinyl stabilizer
Water-proofing
agents
Wire-drawing
compounds

BARIUM RICINOLEATE

CADMIUM RICINOLEATE

CALCIUM RICINOLEATE

MAGNESIUM RICINOLEATE

ZINC RICINOLEATE

Cooperation of our Sales-Service
Department is always available.

The convenient coupon clipped to your letter-
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LOS ANGELES • CHICAGO

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120 Broadway, New York 5, N. Y.

Please send samples of the following
Ricinoleates:

Barium ☐ Cadmium ☐ Zinc ☐
Calcium ☐ Magnesium ☐

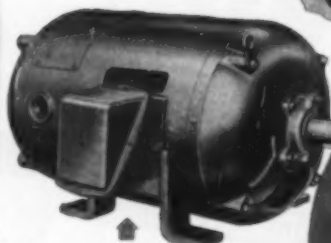
Name _____
Title _____
Firm _____
Address _____

**In motors
from 1 hp up**

you're a step

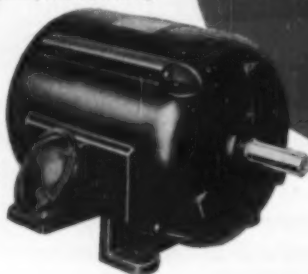
Looking for a dependable motor in any standard type, 1 hp or larger? You'll find it in this complete line, with the backing of the Crocker-Wheeler name plus the Elliott name — double assurance that you're getting as fine a motor as skilled engineering and veteran workmanship can turn out... Some representative types shown below. Write for bulletins.

DC dripproof and drip-proof-protected types Form F, in ratings to $7\frac{1}{2}$ hp. Form H, 10 to 200 hp.

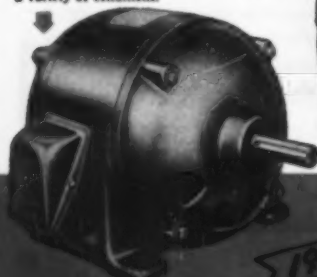


Wound-rotor protected type Form BW. For slow, smooth acceleration, high starting torque with low starting current, or variable speed. Drip-proof, splash-proof, 1 to 200 hp.

Squirrel-cage, totally-enclosed, non-ventilated Form BE. Available up to and including 3 hp at 1800 rpm, for applications requiring protection against dust, fumes, moisture.

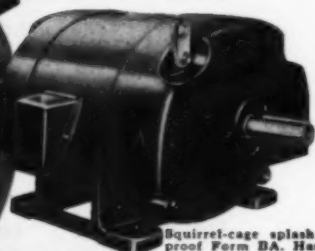
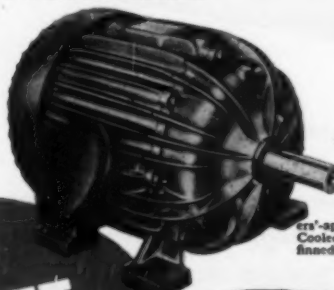


Squirrel-cage protected type Form BA. An open dripproof motor for general purpose use. Available in wide modifications to meet a variety of conditions.

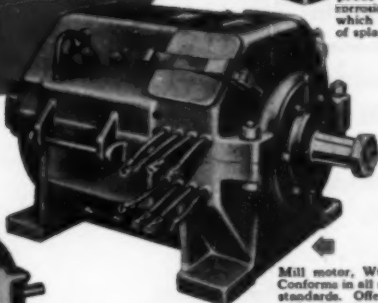


Brake motor using latest disk type brake mounted on BA dripproof motor. Also available with totally enclosed and splashproof enclosures for AC or DC applications.

"Sealedpower" totally-enclosed fan-cooled squirrel-cage motors, 3 to 125 hp. Also explosion-proof underwriters'-approved, 30 to 125 hp. Cooled by air blown along the finned outer case.



Squirrel-cage splash-proof Form BA. Has corrosion-resistant covers which prevent entrance of splashing liquids.



Mill motor, W600 Series, DC. Conforms in all respects to AIEE standards. Offers more power without increase in frame size.

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Integral
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Looking for a really big motor—big in quality as well as capacity? These fine Elliott motors have the exceptional strength and rigidity of welded steel construction in frame and spider with a number of other notable advantages. Fabri-steel construction marks the greatest advance in large motor design and construction since the turn of the century. Some of these outstanding motors are illustrated below. Bulletins for the asking.

Synchronous motor for gas compressor drive. Available with solid or split rotors, open or enclosed, engine type or coupled type, rigid construction.

Totally-enclosed fan-cooled motor, cooled by heat exchanger located at top of unit. Two-pole ratings 350 to 4000 hp. For lower speeds, sizes equivalent to 50-hp, 14-pole, to 3000-hp, four-pole.

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large
motors**

Large two-pole squirrel cage induction motor (350 hp up). A long forward step in two-pole design. Typical Elliott welded steel construction enables widest variation in type of enclosure.

Squirrel-cage induction motor, four to 14 poles, 150 to 2000 hp. All enclosure types.

Outdoor splashproof squirrel-cage induction motor especially designed for outdoor installation without protective covering. 150 hp, 14 pole to 2000 hp, four-pole. 300 hp to 1000 hp two-pole.

Wound rotor induction motor. Simple, strong fabricated construction, sleeve or anti-friction bearings. Available in all types of enclosure.

Vertical outdoor splashproof squirrel-cage induction motor. Can also be made in open dripproof or indoor splashproof with minor changes in ventilating baffles.

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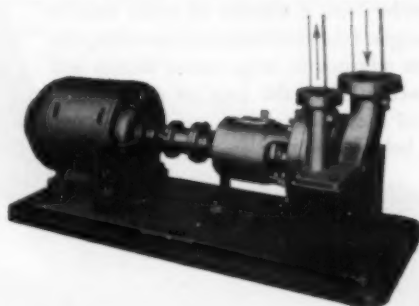
L-808

Five Ways to Measure the **REAL ECONOMY** of Process Pumps

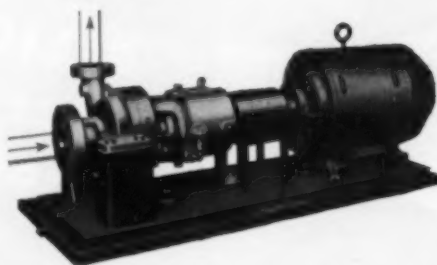
- 1. SAFETY**—With I-R refinery pumps, there's no possibility of hazardous leakage at any point. The extra-strong casing, with single ring joint, is easily kept tight. Ample cooling, pressure breakdown and effective sealing minimize stuffing-box seepage. All pumps may be furnished with the Cameron Shaft Seal.
- 2. DEPENDABILITY**—To assure maximum continuity of service, these pumps are designed and constructed with materials to withstand the most severe service conditions. Heavy shaft, mechanically and hydraulically balanced impellers, and water-cooled, oil-lubricated bearings permit trouble-free operation at liquid temperatures up to 800°F.
- 3. LOW MAINTENANCE**—These pumps are constructed to last longer. Their overall simplicity with all parts easily accessible means less outage for inspection and maintenance. The bearing cradle and rotor can be removed without disturbing piping connections or motor. The single casing joint, with metal-clad ring gasket, is easy to open and re-seal.
- 4. SUSTAINED HIGH EFFICIENCY**—I-R process pumps are designed and built to retain their original high efficiency over years of operation. This means lower power cost per gallon moved—over a longer period of time.
- 5. EASY INSTALLATION**—Flexibility of suction and discharge arrangement makes these pumps adaptable to any piping layout. Various types of nozzle flanges are available to meet your exact requirements.

These five factors add up to real, long-range economy. That's why so many refineries and process plants have installed Ingersoll-Rand pumps. Your nearest I-R representative will be glad to give you complete details, and help you with any application problems you may have.

Ingersoll-Rand pumps rate highest on every point



With top (or bottom) suction and discharge.
Capacities—to 1100 gpm.
Pressures—to 275 psi.



With end suction and top discharge.
Capacities—to 3200 gpm.
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Capacities—20 to 3000 gpm.
Pressures—to 300 psi.



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Pressures—to 500 psi.



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Pressures—to 3000 psi.



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Capacities—10 to 400 gpm.
Pressures—to 1500 psi.



Vertical, turbine-type—
1, 2, 3 or more stages
Capacities—60 to 3500 gpm.
Pressures—to 300 psi.

What you can do to make the supply of Stainless Steel
go further



Make full use of the steel you get by keeping down scrap losses in your shop

Keep these points in mind, too, when you order Stainless

Tell your supplier exactly
where you'll use Stainless and
how you'll fabricate it.

Minimize scrap losses at the
mill by ordering the exact
sizes that you will use.

Indicate, if possible, acceptable
alternates in composition,
gage and finish.

Holding your own scrap losses to a minimum to make the fullest use of the steel you receive is good shop practice anytime. It's especially important today.

Here are a few suggestions that may help you stretch your supplies. See that they are followed. Add other rules that your operations may dictate.

1. Lay out your jobs to use steel as economically as possible. Then order to the closest possible size.
2. Keep your stock of Stainless Steel carefully separated by grades.
3. In your storage areas, make sure that surface finishes are protected properly.
4. Lay down strict rules for careful fabrication and handling. It will help you reduce rejections.

No matter how carefully these rules are followed, there'll always be a certain amount of scrap. To keep new steel flowing to you, get your scrap back into circulation as quickly as possible by *promptly* turning in every pound to the mills.

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NATIONAL TUBE COMPANY, PITTSBURGH • TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM • UNITED STATES STEEL COMPANY, PITTSBURGH
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CHEMICALS-PLASTICS

FOR YOUR INFORMATION

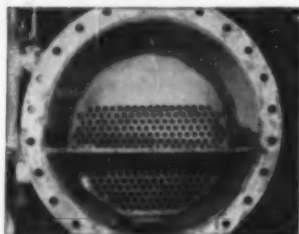
Every month Monsanto publishes these pages of pertinent information which may be helpful to you. This issue discusses:

Detergents
Slime-Control Chemicals
Plasticizers

Heat-Transfer Medium
Special Chemicals
Wetting Agents

Additional information on any of these subjects will be provided by any Monsanto Sales Office in response to your request by coupon or letter.

Santophen 45 controls slime in recirculated cooling water... Here are figures to prove it!



WITH SANTOPHEN 45—This is an unretouched photo of an intercooler condenser, which had not been cleaned since the beginning of the Santophen 45 test in late 1949. The unit contained no slime and practically no corrosion.

These statistics were compiled from observations made on recirculating systems at one of the plants of Monsanto Chemical Company.

During 1948 and 1949, before Santophen 45 was introduced, the slime problem was acute in a Monsanto 12,000-gallon-capacity air-conditioning cooling tower. To keep the system working efficiently, from

three to five mechanical slime cleanouts were needed yearly. These operations cost from \$300 to \$500 each. Santophen 45 was introduced into the system late in 1949 and has been in continuous use since.

Results of a definite period of observation are as follows: On July 3, 1950, Santophen 45 was added at the rate of 100 parts per million. This required only 10 pounds of Santophen 45 for the 12,000-gallon system. Such applications were made biweekly until later in the fall when they were put on a weekly basis. In all, 350 pounds of Santophen 45 were used at a cost of \$119. Throughout the year, the exchangers gave a high level of heat transfer and did not require a single shutdown for mechanical cleanout.

Santophen 45 (sodium trichlorophenate, technical) can be used alone or as an extender for hard-to-get slime-control agents such as chlorine, sodium hypochlorite, sodium pentachlorophenate and others. Used in combination with other slime-control chemicals, enhanced action against a wider range of microorganisms is achieved. Santophen 45 is particularly effective in cooling waters acidified to pH 5.5 to 6.5.

For a test sample, technical data and availability information, mail the coupon or contact the nearest Monsanto Sales Office.

THREE BAI-ACCEPTED NONTOXIC PLASTICIZERS

Available to manufacturers of food-packaging materials are three Monsanto Plasticizers which have been accepted as nontoxic by the Bureau of Animal Industry of the U. S. Department of Agriculture.

These are: Santicizer * 141 (octyldiphenyl phosphate), Santicizer B-16 (butyl phthalyl butyl glycolate) and Santicizer No. 15 (ethyl phthalyl ethyl glycolate).

For prices, data and technical aid in formulating nontoxic packaging materials, mail the coupon or contact the nearest Monsanto Sales Office.

Round 'em up... send 'em home

If you have empty carboys, returnable drums or tank cars around your plant, please round 'em up and send 'em back to your supplier promptly. Shipping containers are in short supply. Returning containers helps your supplier give better service.



RESEARCH CHEMISTS' CORNER

You may find something new here

Here's another new Monsanto chemical that is now available in semicommercial quantities. Like other new chemicals previously mentioned in this space, Diethyl Succinate is worth considering for its possibilities in developing and improving products. Experimental samples will be furnished on request.

DIETHYL SUCCINATE

Formula:



Mol. Wt.
174.2

Approximate Properties:

Acidity (as succinic acid): .01% max.

Appearance and Color: Essentially colorless, clear mobile liquid.

Assay: 99+%

Boiling Point: 120° C. at 30 mm. Hg.

Crystallizing Point: Approx. -20°.

Odor: Slight odor.

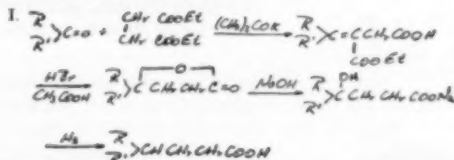
Refractive Index n_D^{25} : 1.417-8.

Specific Gravity at 25° C./25° C.: 1.037-9.

Solubility: Insoluble in water. Soluble in alcohol and ether.

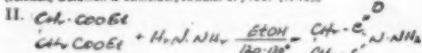
Wt. per U. S. Gal.: 8.7 lbs. at 25° C.

Preparations that can be made with diethyl succinate which cannot be made directly from the anhydride:



If either "R" or "R'" is aromatic, ring closure can be carried out by standard methods.

[Johnson, Goldman & Schneider, J.A.C.S. 67, 1357 (1945)]



[Curtis, J. Prakt. Chem. [2] 92, 102 (1915)]

Ortho-nitrobiphenyl, low-priced plasticizer that's efficient... and available

If costs and availability of plasticizers are headaches in your business, we suggest you investigate Monsanto's ortho-nitrobiphenyl. ONB is efficient as a primary plasticizer or as an extender, and it is immediately available in any quantities you need. It sells for only 14½ cents a pound in truckloads or carlots.

Ortho-nitrobiphenyl (also known as ortho-nitrodiphenyl) is compatible with cellulose esters and ethers, polyvinyl chloride, polyvinyl butyral, polyvinyl acetate, styrene, rosin and rosin esters, modified phenolic resins, oil-soluble alkyd resins and vegetable oils. This wide compatibility, plus its low hydrolysis rate and low price, makes ONB an unusually attractive plasticizer.

Most resins, both natural and synthetic, can be plasticized with ONB. The amount of required plasticizer varies with the resins and the use of the finished product. The volatility of ortho-nitrobiphenyl is less than diethyl phthalate and greater than dibutyl phthalate.

Ortho-nitrobiphenyl is readily soluble in carbon tetrachloride, mineral spirits, pine oil, turpentine, benzene, acetone, glacial acetic acid and perchlorethylene. It is, itself, a good solvent.

For technical information on ONB, contact the nearest Monsanto Sales Office or mail the coupon for a copy of Monsanto Technical Bulletin No. OD-102.

Nonflammable heat-transfer medium

For more than eight years, Monsanto AROCLOR® 1248 (chlorinated biphenyl) has proved an ideal nonflammable, liquid-phase heat-transfer medium. AROCLOR 1248 can be used continuously at temperatures up to 300° C., and at pressures of 30 pounds per square inch or less. Mail the coupon for details.

Santomerse No. 1, all-purpose detergent and wetting agent, serves many industries

To name the industries that have use for Monsanto Santomerse® No. 1 would amount to compiling a directory of American manufacturers. Versatility of the product makes it a valuable assistant in many operations.

Santomerse No. 1 is effectively used for cleaning, penetration, dispersion, emulsification and spreading.

Santomerse No. 1, an anionic detergent, has a minimum of 40% active alkyl aryl sulfonate, the remainder being principally inorganic builders. This combination has been found to be best for high efficiency and economy.

Usefulness of Santomerse No. 1 covers a wide range of applications because the product is effective in hard or soft water, in acid or alkaline baths, in hot or cold solutions. Santomerse No. 1 can be used in operations where the pH is critical because it assumes the pH of the solution in which it is used.

There may be many places where Santomerse No. 1 can improve efficiency and help you to turn out better products. Why not investigate these possibilities? Mail the coupon for a copy of Monsanto's

booklet "Santomerse No. 1... All-purpose wetting agent and detergent," which contains a great deal of technical information which may be useful to you.

A few of the many uses of Santomerse No. 1



Metal Industry



Railroad Car Cleaners



Household Cleaners



Hairing Hogs



Dairy Cleaners



Agricultural Sprays

These half-dozen uses of Santomerse No. 1 may suggest applications in your business. If you want detailed information on specific uses in your industry, contact the nearest Monsanto Sales Office or write Monsanto Chemical Company.

New detergent offers you flexibility in formulating

Monsanto now has available in commercial production a new detergent and wetting agent—Santomerse 80. Santomerse 80 contains the same active ingredient as Santomerse No. 1, but is double strength. It has 80% of active alkyl aryl sulfonate, the remaining 20% being principally inorganic builders.

Santomerse 80 is a synthetic detergent in concentrated form which gives more flexibility in formulating. It is recommended for specialty compounds where low inorganic content is desired. Its high concentration of active alkyl aryl sulfonate permits a reduction in bulking of the finished detergent mixtures, where this characteristic is desirable. In addition, it reduces the requirement for warehouse space and material handling.

Santomerse 80, available in flake form, can be blended easily with phosphates, carbonates and silicates. For complete information, mail the coupon.

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☐ Santomerse 80. ☐ AROCLOR 1248.

SEND LITERATURE:

- ☐ Bulletin OD-102 (ONB).
☐ Booklet, Santomerse No. 1.

SEND SAMPLE:

- ☐ Santophen 45. ☐ Diethyl Succinate.

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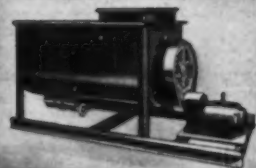
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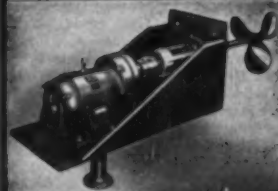
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Victor J. Kropf

What Makes Up a Motors Report?

Mostly a lot of hard work, says Vic Kropf, whose comprehensive report in this issue is the first of its kind to be prepared especially for chemical engineers.

For years we'd talked about doing a special job on motors and motors control—a handbook type of report slanted for chemical engineers rather than for the electricals.

We knew there was a need for it. Many readers told us so. Besides, in many plants the chemical man is the only engineer around the place and so is forced to cope with his electric motors—the common denominator of chemical processing operations—all alone.

We gathered a lot of working material but never quite buckled down to the real task of writing the report. The size of the job, I guess, made it easier to put off.

Then on a trip to Pittsburgh last October I met Vic Kropf, who heads up Westinghouse's petroleum and chemical section. Now Vic, who's actually an electrical engineer ('36) from Armour Institute of Technology, has spent close to 15 years with the where's, how's and why's of motors and other electrical equipment in the chemical, petroleum and materials handling fields. He has an intimate knowledge of these industries throughout the United States.

"Here's the man for the job," I thought to myself, "if only I can persuade him to tackle it." So I asked him. He was willing. "Mostly because I thought of it then as an article—maybe two—that I could farm out to one of our engineers," Vic now admits.

Within a month or so Vic came to New York and we began to crystallize our ideas. Our Ted Olive worked up a preliminary outline.

"I began to realize I really was in for something," Vic confesses. "I took Ted's outline and studied it. Then I made some changes and sent it back to you for your comments. As I recall, the outline was six pages long. By that time I'd become so enthusiastic I doubt if you could have held me back even if you'd wanted to."

"The deeper I dug the more I realized I'd have to dig deep. I did quite a bit of research as well as review our own files of information here at Westinghouse. I also spent plenty of time going over other manufacturers' literature to be sure I'd cover all available types of motors and control. I've avoided controversial subjects, since the purpose of the report is to

give basic information to the process engineer. All in all, I certainly learned a lot about motors during those three months!"

Vic, I've since learned, really put all he had into the job. He even worked on it during airplane flights, on train trips and during stints at baby sitting. Once, he tells me, a deacon caught him making notes during church services.

"I'm proudest of all," Vic boasts, "that I actually finished the job a couple of days before your deadline. Remember when one of my Westinghouse associates warned you that I'd probably never complete it? That was a challenge I had to meet."

Now that the job is done, Vic will be able to spend more time gardening in Penn Township, near Pittsburgh, with his wife Jane and his two young daughters. And to take up again his family's favorite outdoor sport—canoeing at the Sylvan Canoe Club on the Allegheny River. Westinghouse might even get him back as a member of the Westinghouse Male Chorus.

Vic's report (which begins on p. 123 of this issue) covers the fundamental facts about motors and their control: how they function, where they are used, what factors must be considered in their selection for chemical process operations.

This is the first time, to my knowledge, that a report on this subject has been compiled and published for chemical engineers in the process industries. We're proud of it, naturally!

What do you think of it?

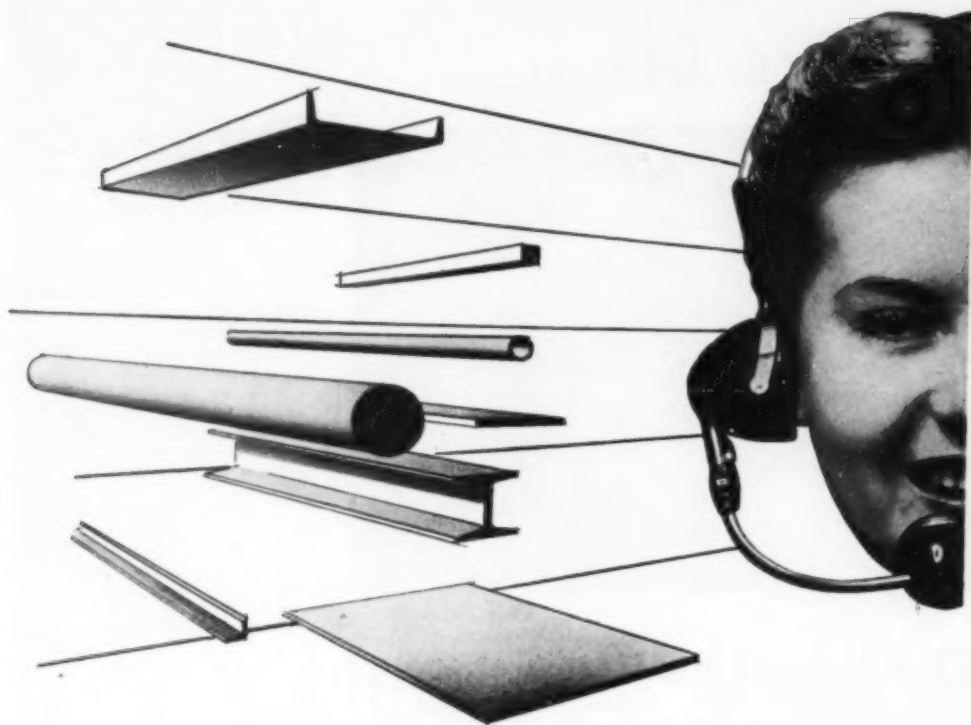
Watch For These . . .

Synthetic Fibers: An evaluation of the newer synthetic fibers, what they mean to the chemical industries, why they're growing in importance.

Sublimation: Theory, principles, equipment and modern practices. What this "neglected unit operation" has to offer the chemical engineer in the process industries.

Maintenance Costs: An outstanding article on the dollar-and-cents cost of maintenance by types of equipment. A pioneering effort to reduce maintenance cost estimation to a system.

Process News: Next month—and every month—ten pages or more of capsule reports on new processes, production techniques and chemical engineering developments. Turn to Chemical Engineering News, p. 183, for this month's process news.



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Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

JULY 1951

One Voice—or a Babel?

As the Manufacturing Chemists Association enters its eightieth year, it faces unprecedented problems—and opportunities.

Governmental regulations and controls now affect the functioning of every chemical plant in the country. Misunderstanding of our motives and inadequate knowledge of the character and contributions of chemical industry are definite handicaps to all of us. Surely, there is need now for strong leadership and effective action on many fronts.

How well does MCA measure up to these heavy responsibilities? Last month's annual meeting at White Sulphur gave us part of the answer in the new vigor with which this oldest of our trade associations is tackling the industry's current problems. The expanded program inaugurated a year ago is beginning to show results.

- ▶ Merger with the Plastics Materials Manufacturers Association and its integration into MCA have been accomplished in the face of considerable difficulties.
- ▶ Real leadership was shown in the industry-wide conferences on the abatement of stream and air pollution, in the hearings on restrictions in the use of chemicals in food, and on the tariff and international situation.
- ▶ For the first time, at least in recent years, an organized program has helped to keep group effort in tune with the needs of the member companies.
- ▶ Members have had an opportunity to learn how much they are being benefited by the comprehensive activities of the association.
- ▶ A substantial start has been made toward a more aggressive and progressive program of public relations for the industry as a whole.

That all this takes time and money is something the chemical industry has been slow to recognize. For many years, it has been satisfied to have its principal trade association confine its activities largely to technical matters, such as transportation, packaging and safety measures for plants and laboratories. The annual meetings have always been pleasant occasions to bring together the top executives of the industry, but only a relatively few participate in the real work of the organi-

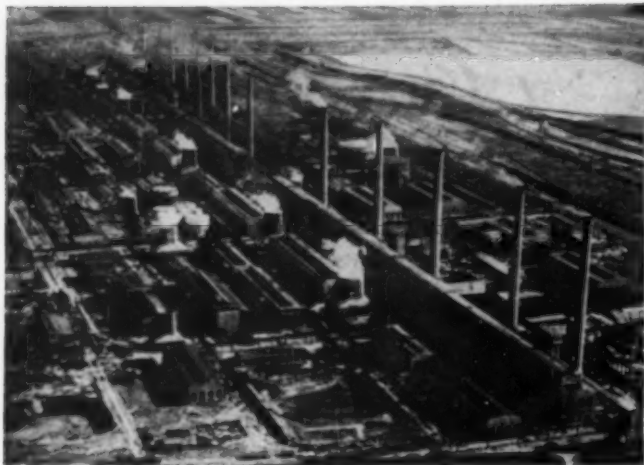
zation. MCA's annual budgets, as compared with those for the associations of other process industries such as petroleum, iron and steel, pulp and paper, have been pitifully small. It takes times like these to bring home the realization that money invested in group effort can accomplish many things that the individual company cannot even attempt.

If the Manufacturing Chemists Association is to take its proper place as the accepted spokesman for the industry in national affairs, it must have the generous support and cooperation of all chemical companies, large and small. Furthermore, it is essential that within the ranks of each member company there is opportunity for participation not only by chief executives and a few technical specialists, but by all who are concerned with the progress of the chemical industry and profession.

This vertical integration of interests and activities is probably the single, most important means for strengthening the organization within the industry itself. Following the pattern set by the PMMA consolidation, there should be a place in MCA for other product groups. Important and efficient organizations such as those now serving synthetic organic chemicals, agricultural chemicals, chemical specialties, and similar subdivisions of chemical industry, could undoubtedly become more important and more efficient if properly integrated into an over-all organization. Again, however, it is our conviction that such a consolidation should be made, not to save money but to spend more, with greater efficiency for the greater good of a united industry.

As we chalk up a year of substantial progress for the industry's oldest trade association, let's not be too impatient. Rome wasn't built in a day. MCA has already rendered services to our industry and country that can never be measured in dollars and cents. But let's not be satisfied until we have made our association truly worthy of a progressive industry that is not only rich in human and financial resources, but also wide awake to its opportunities for public service.

Sidney D. Kirkpatrick



As at Leuna, in this pre-war picture, rows of power-plant stacks made a wonderful guide for bombing raids; surprisingly enough, as at the Tokuyama Refinery, stacks were seldom destroyed by bombing.

Can Process Plants Protect Themselves Against Enemy Bomb Attacks?

As members of the U. S. Strategic Bombing Survey the authors have drawn important conclusions regarding the effects of attacks on process plants from observations in Germany and Japan.

F. W. SULLIVAN, JR., and L. E. CARLSMITH

The downfall of two great industrial nations, Germany and Japan, in World War II was the consequence of loss of strategic materials. In the case of Japan, this was due to the blockade; in the case of Germany, it was the result of the strategic bombing of oil, chemical, and rubber plants, particularly the first. The conclusion of the Oil, Chemical, and Rubber Division of the U. S. Strategic Bombing Survey was that the defeat of Germany would have been hastened if the program of bombing such objectives had been started earlier and con-

centrated on more effectively. Since Germany had embarked on a program of national self-sufficiency and had more natural resources, the German economy was not nearly so vulnerable as that of Japan. In the latter country the natural resources were so limited that complete strangulation and industrial stoppage were effected by blockade alone. The ineptitude of the Japanese in scientific and especially in industrial matters, and restrictions imposed by the military, also added to their inability to keep the military machine supplied with essentials.

The so-called "active defense" measures against air attack consisted of fighter planes and anti-aircraft batteries and these were both the concern of the military authorities. Neither of these defensive measures was adequate to safeguard industrial operations against interruption.

The "passive defense" may be subdivided into several categories. The German air raid warning service transmitted information concerning number, kind, and location of enemy

planes to the central air raid offices of plants. In accordance with warnings from these offices, fire-fighting crews were readied, watchers were dispatched, and the initial stages of shutdown procedures were carried out. As planes approached closer, the later stages of preparation were ordered and final shutdowns were carried out.

In general, the system was to order the less critical personnel to the shelters first, especially women, as much as an hour before the attack was anticipated. Then steam was shut off certain parts of the plant, non-continuous units were shut down, pressure was let down on hydrogenation units and plants where flammable liquids were being processed were closed down when possible. Only at the last minute did the most necessary people, such as power house personnel, go to the shelters.

The training of personnel in air raid protection organizations was highly developed. At the large I.G. plant at Leuna, 19,000 people were enlisted in the air raid system. They were organ-

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ized into alarm receiving and sending groups, contact groups, recording groups, watchers, first-aid crews, emergency repair crews, gas detection and decontamination squads, and the fire-fighting force. At Leuna there were 3,100 fire wardens and 2,400 full-time firemen. The air raid organization at the other large I.G. plant at Ludwigshaven-Opau was set up similarly and had a large staff of specialists for the repair of gas and water lines, steam lines, cables, railroads, and so on.

Blackout helped to limit accuracy of night bombing. Camouflage was used and of the various devices, decoy plants and smoke screens were the most effective. However, architectural features of the plants sometimes served as excellent guides for the Allied bombing crews. For example, at Leuna, a long row of power plant stacks down the center of the plant proved an invaluable guide to Allied bombardiers. Still, despite their prominence, stacks were among the least vulnerable kinds of equipment and were seldom damaged to any serious extent.

A wide variety of devices for the protection of personnel was employed in Germany. These ranged from units to protect one man, to six story structures with reinforced concrete roofs 12 ft. thick, which could provide protection for up to 4,000 people. Such a structure could take a direct hit from a 1,000-lb. bomb without injury to the occupants. The Japanese used small air raid shelters, most of them being covered trenches. These, however, were effective against all but direct hits.

Compressors, motors, and other critical equipment were protected by various means against bomb splinters. Dry brick walls were effective against such hazards. Reinforced concrete "dog-houses" were effective against near misses but several feet of reinforced concrete was provided when protection of personnel and vital



These views from the Tsurumi Refinery (left) and the Imperial Fuel Industry show the vulnerability of such equipment as distilling columns and working platforms.

equipment such as transformers, prime movers, pumps and compressors against direct hits was desired. Distillation units were extensively protected against flying splinters, while tanks holding flammable liquids were sheltered by heavy walls. A novel and effective protection for still columns used at many plants in Germany was to swathe the column in metal turnings, held in place by wire mesh.

In the case of direct hits, when full protection was not provided, it made little difference what type of equipment was involved: damage was always extensive. The only exception was in instances of extremely heavy equipment, such as high-pressure chemical plant and steel-mill equipment. In one case personnel was sheltered under the extra-reinforced foundations of a high-pressure compressor installation. Where direct hits were not incurred, it was found that fragile equip-

ment was not especially subject to damage. Instruments were not generally given special protection and showed no special vulnerability to shock. In fact, destruction by shock was not nearly so extensive as anticipated, although it may have been a factor in the disastrous effects of bombing on underground utility conduits. Damage from splinters, blasts and fires was the usual effect of near misses. Lightweight construction materials such as tile and asbestos-cement were readily destroyed by blasts but the loss was of little consequence. The resistance of heavy equipment to direct hits was indicative of the use of bombs that were too light.

If there is any conclusion justified concerning the relative merits of light vs. heavy roof construction, it is that light roofs are preferable since they blow to bits readily, whereas the fragments of a heavy roof themselves contribute considerably to the damage.

Outdoor plant construction was less generally used in Germany and Japan than in the United States. This does not seem to be a significant factor, however, since there is not much difference in vulnerability of similar indoor and outdoor installations, *per se*.

The large-scale dispersal of existing plants was not carried out to any extent, although dispersal and the construction of underground plants were projected. Several aircraft assembly plants had been set up underground both in Germany and Japan. In the case of individual plants there was usually considerable advantage for those that were well spread out, compared with more congested plants.

IF ENEMY BOMBS SHOULD FALL—

1. Bombing of process plants cannot be entirely prevented, nor can extremely serious damage be averted. Best defense is to concentrate on preventing attack.
2. U. S. plants are far better dispersed than were those of the Axis Powers—hence vital damage to the national economy would be much more difficult to achieve. Also, they are less congested.
3. For these reasons, and because bombing accuracy is normally poor, it seems unwise to diffuse our productive capacity by installing elaborate precautionary measures such as camouflage, decoy plants, smoke screens, blast walls, and underground plants, except in rare cases.
4. However, there is justification for comprehensive fire prevention and control measures, study of modest personnel shelters, education in disaster control, blackout in some cases, and especially for anti-sabotage measures.



German plants used many brick walls around storage tanks. In this case a direct hit destroyed both tank and wall.



At the other extreme, the Japanese used quite effective earth and bamboo shelters, as at the Tsurumi Refinery.



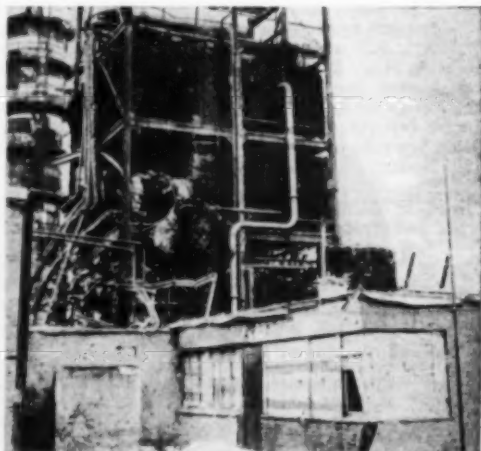
Overhead piping always experienced extensive damage, as this German plant view shows; however, repair was easier than with underground piping.



As with piping, other utility lines were extremely vulnerable. This is the main transformer substation of Toa Oil Co., at Wakayama. A near miss caused the damage.



Heavy equipment, such as large compressors, stood up well against bombing; here, at Braunkohle Benzin A.G., protection in the shape of reinforced concrete is provided over the drive end, loose brick for the rest.



Several German plants used metal turnings or steel wool, packed around distilling columns, as protection against fragments. The protection was not effective against blast however, as this Braunkohle view shows.

The advantage was more evident in preventing the spread of fire than in resistance to the direct effects of bombing.

In spite of superior preparation and organization in Germany, the effects of air attacks were always catastrophic. Every time 1 ton or more of bombs fell on the Leuna plant, it was put completely out of operation. This one plant suffered over 5,000 breaks in water, steam, gas, and electric lines during 22 attacks and this was the main cause of shutdowns. Underground utility lines were found to be somewhat less vulnerable to the effects of bombing, but when such lines were damaged the added difficulty of repair gave a great advantage to the overhead utility lines. Although damage to utilities was repairable, it was the experience at Leuna that, after the first two attacks, 94 percent of the damage of this sort had to be repaired before the plant could start up. It became impossible to provide enough repair labor to keep up with the damage. In fact, while the total non-maintenance personnel employed in the German synthetic oil plants in the summer of 1944 was less than 90,000, over 150,000 were employed in repair work at those same plants at that time.

In the long run their remarkable ability at putting bomb-damaged plants back to work proved no real benefit to the Germans, although they made out well for a time. The German plants went in heavily for relatively small, duplicated units which permitted wide-spread salvage and cannibalizing. But, they did not have extensive arrangements for mutual assistance among various plants, nor was there any general use of master plans allocating priority for repairs and materials to specific plants.

The Japanese made an attempt to copy German plant protection measures, but their efforts were relatively superficial. As a result most Japanese oil refineries and chemical plants were permanently out of operation after one or two air attacks, even when these were not especially severe. Often the Japanese failed to anticipate the possibilities for danger in relatively obvious situations. For example, the Akita Refinery of the Nippon Oil Co. was located adjacent to an unprotected tank farm on higher ground. When light bombs opened up the tanks, burning oil flowed downhill and destroyed the refinery.

The inability of the Japanese readily to repair their plants was also in contrast to the spectacular return of the German plants to partial production after attacks. By the time their

industrial installations were attacked, the Japanese people showed little zest for backing the war effort. In fact, it was common practice to evacuate a plant at the first alarm. At the integrated chemical plant of the Mitsui Industries, at Omuta, a rubber belt conveyor between the coal mines and coke ovens was burned up by incendiary bombs spilled over into the plant during an attack on the city. The plant closed for the duration of the war although otherwise undamaged!

Casualties were always high on the first attack despite pre-raid training. At the Leuna works, of a total of 274 killed, 126 were killed on the first attack and similar situations occurred elsewhere. From the small number of casualties later, it is evident that the precautions were adequate but that the victims of the first attacks had not been properly impressed. Although it is true that secondary damage resulted from the destruction of personnel, of raw materials, and of transportation, the primary cause of the stoppage of German production was the damage to plant facilities and equipment. It was this prompt and complete stoppage of production which resulted very promptly in the collapse of the German war machine.

In view of these German experiences, what are the prospects of a similar fate befalling the United States? The points of greatest German vulnerability were in the production of fuel and lubricants which are the concern of the American petroleum industry, the production of nitrogen, an essential to munitions manufacture, and the production of rubber, which has many military applications. These are all products of the chemical and related process industries and they are all consumed in large quantities. The German fuel and lubricants industry was vulnerable because it had an inadequate inventory (two to three months' supply), and it was dependent to a large extent on synthetic fuels plants which were concentrated into a relatively few installations which were easily reached by Allied aircraft. German oil came from 87 sources, but 25 percent of it was natural oil and half of this was processed in 17 refineries in northwest Germany. About twice this amount of oil came from only 11 coal hydrogenation plants. (Incidentally, all the aviation gasoline came from these latter plants.) These figures show that 60 percent of German oil came from less than 30 plants, all accessible to bombers. Although the total German capacity for producing motor fuels and lubricants was a small fraction of that in the United States—about 5 percent in 1944*—

this was adequate for military needs because of the non-dependence of civilian transportation on liquid fuels. On the other hand, this left a pretty small target to attack from the air. When it was wiped out, the Luftwaffe was grounded.

In contrast, the American petroleum refining capacity today is at least 52 percent larger than it was in 1944. No single refinery has more than about 41 percent of total capacity, and there are refineries in 37 states of the Union.

The situation in Germany with respect to synthetic nitrogen, a prime military necessity, was shocking: Over half of the synthetic nitrogen production was at Leuna and Oppau, an astounding concentration. These same plants produced an even larger proportion of the methanol. However, American production of ammonia is widely distributed, with no less than 20 nitrogen fixation plants in 11 states.

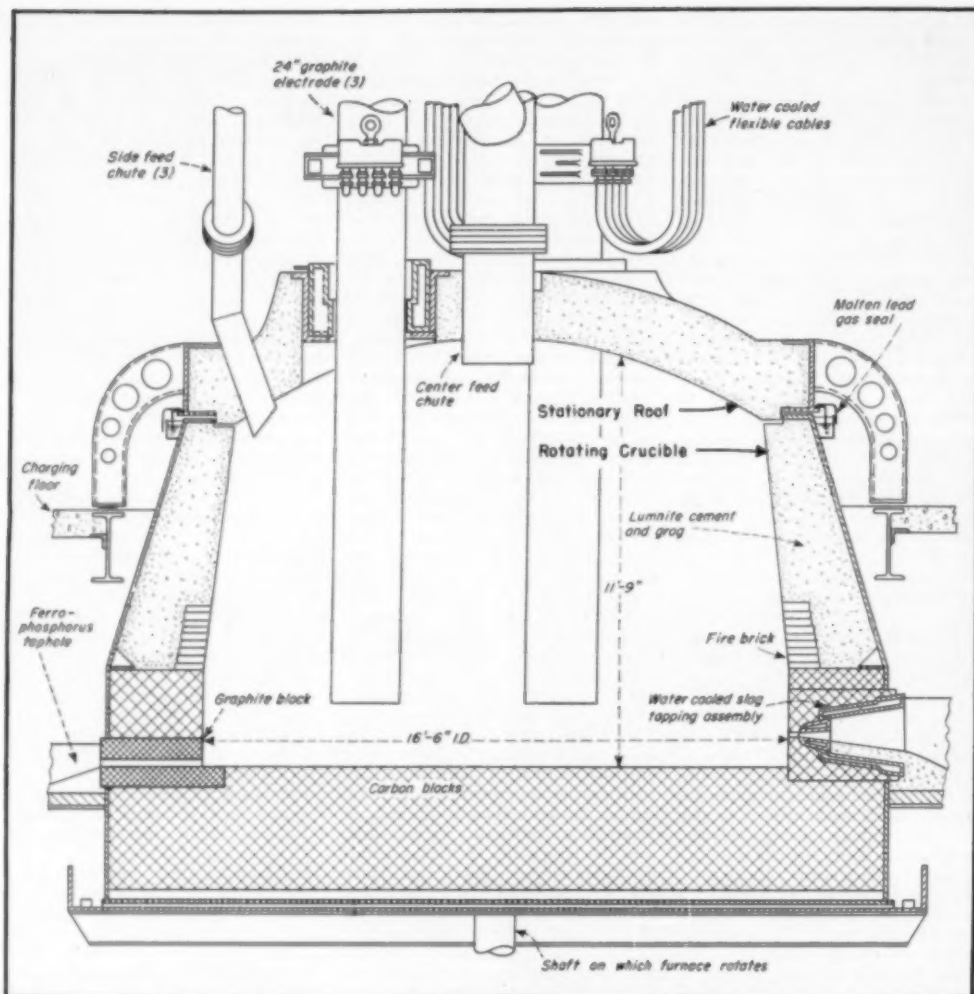
Over half of Germany's production of synthetic rubber came from Schkopau, part of the Leuna complex, and most of the remainder came from Huels, with minor contributions from Ludwigshaven and Leverkusen. The plant at Schkopau was not damaged, but when Leuna was damaged, Schkopau was virtually shut down for lack of raw materials. The American industry, on the other hand, is now headed for an annual synthetic capacity of about 1,000,000 long tons, produced in plants at 15 locations, and in seven states.

These comparisons have been made because it is obvious from German experience that a high concentration of production of a commodity in accessible target areas results in great vulnerability. In spite of the essential nature of calcium carbide, sulphuric acid, soda, chlorine, caustic soda, and certain other basic chemicals, these materials never became critical because their production was dispersed and they were, consequently, not vulnerable. For the same reason, because of relatively greater dispersal of American oil, chemical (nitrogen), and rubber production, the effect of bombing on individual installations cannot be so disruptive of the national economy.

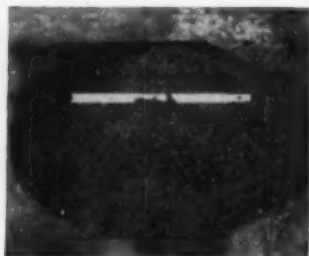
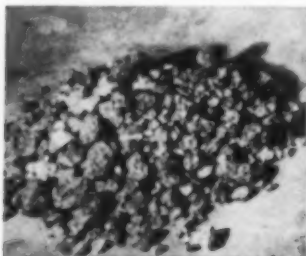
However, this will be scant consolation to the management and workers in individual plants. From past experience it is quite certain that in the event of any bombing attack, casualties on the first occasion will be numerous. Furthermore, in any in-

(Continued on page 115)

* Based on a production rate of 5,590,000 tons per yr. (ca. 45,000,000 bbl.) of gasoline, diesel fuel and lubricants for Germany in the early part of 1944, as against a production of 803,000,000 bbl. of motor gasoline, distillate fuel, and lubricants in the U. S. in 1944.



ROTATING crucible (note stationary roof, electrodes, cables, feed chutes) of first new furnace significant to phosphorus industry in particular, all electric furnace users in general because inexpensive fines can now be used instead of expensive lump or sintered phosphate. Gas offtake is not shown in this view.



LUMP or sintered phosphate rock (left) is used in stationary units. Costs are high, but fines (center, right,) low in cost, now for the first time are made usable with rotating unit.

This Phosphorus Furnace Rotates

A PROMISING NEW IDEA BECAUSE:

It produces phosphorus with less power consumption.

Direct smelting of phosphate fines is possible.

The furnace lining lasts longer.

M. M. STRIPLIN, JR., DAVID McKNIGHT, G. H. MEGAR and J. M. POTTS

TVA recently closed the circuit on a brand new large-scale rotating electric furnace.

Built after extensive pilot-plant work, the new furnace is similar to the Norwegian ferroalloy and carbide furnaces.^{1,2}

WHAT AND WHY ROTATE?

In a rotating furnace, the crucible and its contents move slowly around the electrodes which are suspended vertically into the charge.

Result is smoother operation because the formation of cavities in the furnace charge is lessened. These cavities are formed when the charge does not flow continuously into the reaction zone fast enough to replace the material fused.

The rotating furnace diminishes this problem, favors the possibility of smelting the low-cost, unagglomerated phosphate fines rather than the high-cost lump materials used previously.

FROM THE PILOT PLANT

Obviously, the big problem in designing the pilot-plant furnace was to provide a gastight stationary roof that would permit the crucible to be rotated.

The answer—a seal of molten lead between the crucible and the roof—was ingenious!

Work was begun in 1946. Prior to that year, rotating furnaces were uncovered.

Molten lead is fairly inert to phosphorus vapor, is of high density, minimizing the depth of seal required, and can be used at temperatures above that at which phosphorus condenses from furnace gas (360 deg. F.). The lead was kept molten by submerged electric heating elements controlled thermostatically. For safety, the motor used to rotate the furnace was interlocked with thermostats in the lead

bath which were set to stop operation of the motor before freezing of the lead could occur. Thus the equipment was insured from damage on this score.

THE PILOT FURNACE

The pilot plant consisted of a three-phase 1,000-kw. rotating furnace, electrostatic gas cleaning equipment, and a spray-type phosphorus condenser. The crucible had an inside diameter of 8½ ft. and was mounted on a turntable supported from a circular rail by six wheels. It could be rotated at speeds of 1 rev. in 18 hr. to one rev. in 144 hr. by means of a motor and speed reducers. The electrodes extended into the furnace through gastight packing glands, and the furnace was operated under slight pressure. Three 12-in. graphite electrodes were used. The furnace was fed from overhead bins through six feed chutes that were located at the electrode circle. Gas was then removed either from a point at the side of the roof or from the center of the roof through a duct that contained a ribbon conveyor. Three holes were provided in the crucible at 120-deg. intervals for tapping slag and ferrophosphorus.

EMPHASIS ON FINES

The pilot plant was operated for several months, starting in July 1947. Emphasis was placed on developing ways to smelt phosphate fines, and no attempt was made to determine the optimum conditions for operation of the furnace on lump materials. After preliminary tests in which lump nodules were used without rotation of the crucible, the furnace was cleaned out and operated with rotation on lump nodules for a few days during which the speed of rotation was increased in steps from 1 rev. in 144 hr. to one in 72 hr. Operation of the furnace was continued with further increases in speed of rotation to one rev. in 18 hr. and during this period, progressively larger proportions of the lump nodules in the charge were replaced with minus 6-mesh nodule fines. All the lump nodules in the

charge finally were replaced with nodule fines, and the furnace was operated long enough on this material to show that satisfactory operation was possible. Satisfactory operation was obtained in similar tests with mixtures of lump nodules and minus 4-in. uncalcined Florida phosphate fines and with all the phosphate supplied as Florida fines.

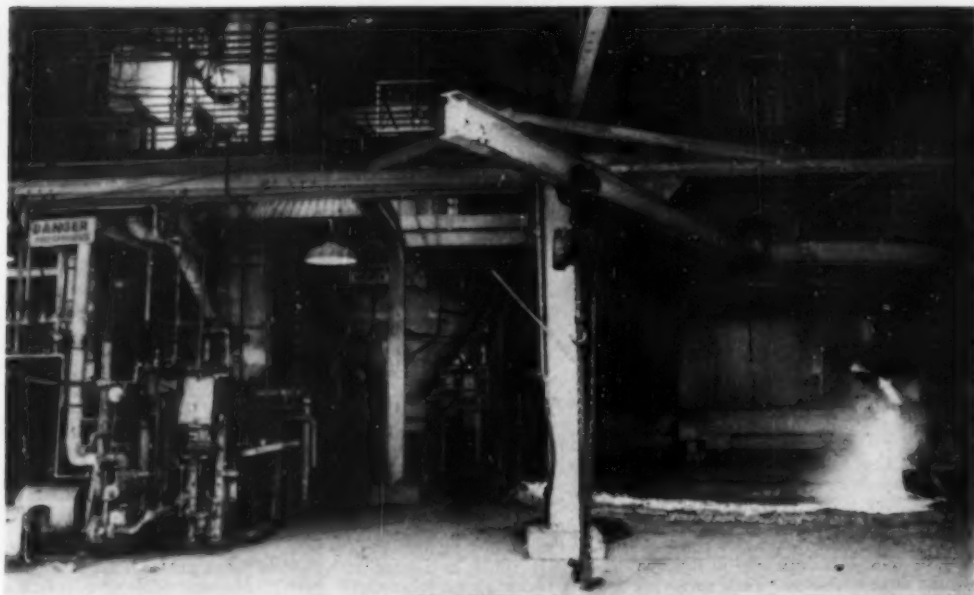
ROTATION PROVED

Operation was satisfactory over the entire range of speeds investigated (0.96 to 7.7 in. per hr. at the electrode circle). No electrodes were broken, although when only phosphate fines were used, significant horizontal thrust occurred at speeds greater than 1 rev. in 24 hr. (5.8 in. per hr. at the electrode circle). The power consumption during the two short periods of operation with lump nodules was about the same with and without rotation of the furnace. However, with rotation, the temperature of the gas was lower and more uniform and the charge was not fused out to the wall. This indicated that the furnace could have been operated at a higher power input.

LARGE-SCALE FURNACE

The large-scale furnace was designed for operation at 7,500 kw. and replaced a stationary furnace in need of rehabilitation. The electrostatic dust precipitator, phosphorus condenser, and appurtenances used with the former furnace were retained, and a transformer with secondary taps from 200 to 375 v. provided increased flexibility for experimentation. The furnace was built to use 24-in. graphite electrodes instead of amorphous carbon electrodes, which are used in the other TVA furnaces. Graphite is stronger than carbon and would be less apt to break. Also it was desirable to obtain data on the relative cost of graphite and carbon electrodes in phosphorus production. The furnace was constructed with a cast monolithic roof similar to that used on other TVA furnaces* and with a hearth made of carbon blocks. The furnace shell and bottom were water-cooled. The cruci-

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PILOT PLANT: 3-phase 1,000 kw. rotating pilot furnace, electrostatic gas cleaning equipment, spray type phosphorus condenser.

ble had an inside diameter of $16\frac{1}{2}$ ft. and was mounted on a turntable supported from a circular rail by 64 rollers.

Crucible could be rotated at speeds of 1 rev. in 15 hr. to 1 rev. in 100 hr. by means of a reversible $1\frac{1}{2}$ -hp. motor and speed reducers. The furnace was operated for 2 mo. without guides on the electrodes and with only one feed chute, which was located in the center of the furnace roof. Electrode guides and three additional feed chutes then were added to improve operation. The available tapping space extended approximately 120 deg. around the furnace. Three equally spaced ferrophosphorus tapholes and three equally spaced water cooled, slag tapholes were provided so that the furnace could be rotated continuously in one direction and still allow for tapping at all times in the space available. With three equally spaced electrodes it is possible to cut through the entire charge laterally by oscillating the furnace through 120 deg. and using only one set of tapholes. The furnace was equipped with limit switches that could be set to reverse the direction of rotation automatically and oscillate the furnace.

Roof of the furnace was supported from the operating floor and was separated from the crucible by means of a molten lead seal similar to that used in the pilot plant. The drive motor was connected so that interruption in the main power supply or cooling of

the lead seal would automatically stop rotation. The same types of electrical-control equipment and instrumentation were used with the furnace as those described in *Chem. & Met.*, Oct. 1938, pp. 536-40. Runners and a sluiceway were provided for recovery of ferrophosphorus and for granulation of slag.

LARGE-SCALE ROTATION

Preliminary operation of the furnace was begun in October 1950 on the same lump nodule charge used in the other TVA furnaces. The speed of rotation was increased stepwise from 1 rev. in 100 hr. to 1 rev. in 20 hr. over a period of several weeks. An electrode broke after the furnace had completed one revolution at the higher speed. At the electrode circle, this higher speed is equivalent to a linear speed of 13.6 in. per hr. Although breakage of electrodes is common with stationary furnaces, this linear speed was about twice the maximum used in the pilot plant and may have caused excessive strain on the electrode. Operation was resumed at a speed of 1 rev. in 35 hr. The furnace was operated 96 percent of the time during the first 2 mo. Several interruptions in rotation were necessary during the first month to allow for adjustments of the rollers and drive equipment. The torque required to turn the furnace occasionally exceeded

the rated capacity of the larger speed reducer, and the shear pins employed for protection of the drive equipment failed and required replacement. This interrupted rotation for about 30 min.

Good operation with essentially continuous rotation was obtained the second month. However, since the pilot-plant work had indicated that higher torques would be required for operation on fines, plans were made to strengthen the drive equipment so that rotation of the furnace would not be restricted. The factors that were observed to affect the torque are alignment of the rollers, depth of the electrodes in the furnace charge, and particle size of the charge.

ADJUSTMENTS

The furnace was shut down for two weeks in December 1950 to make mechanical adjustments and to install the electrode guides and additional feed chutes. Operation was resumed at a speed of 1 rev. in 35 hr. with the original drive equipment, since the new drive equipment was not available. Stock distribution and pressure control were better, and there was a small improvement in power consumption. However, the additional feed chutes increased the average depth of stock in the furnace. This apparently increased the strain on the electrodes and one was broken soon after operation was resumed. In this

PERFORMANCE DATA ROTATING P. FURNACE

	First Run	Second Run
Period, days	24	24*
Time operated, percent of elapsed time	96	98†
Time rotated, percent of operating time	89	80
Power factor	0.98	0.98
Temperature of off-gas, deg. F.	710	700
Temperature of slag, deg. F.	2,600	2,580
P ₂ O ₅ content of slag, percent	1.57	1.36
SiO ₂ /CaO weight ratio of slag	0.77	0.78
Phosphorus content of ferrophosphorus, percent	24.8	23.9
P ₂ O ₅ content of phosphate plus silica, percent	25.4	25.3
Phosphorus recovery, percent of phosphorus charged	88	86
Power consumption		
Kwh/ton P ₂ O ₅ charged	4,200†	4,090†
Kwh/lb. P ₂ produced	5.46	5.44
Electrode consumption, lb. graphite/ton P ₂ O ₅ charged	6.6	7.6

* Excluding time for removal of broken electrode.

† Value based on watt-hour meter of switch house; watt-hour meter on furnace board gave slightly lower values.

RESULTS with furnace operating at 325 v., 7,500 kw. for 1 mo. periods before and after 2 week shutdown for adjustments.

case, also, the linear speed at the electrode circle was higher than the maximum used in the pilot plant. Subsequent operation was at a speed of 1 rev. in 50 hr.—about the same linear speed at electrode circle as the maximum employed continuously in the pilot plant. There has been no further breaking of electrodes. Data for operation at 325 v. and 7,500 kw. for the month before and the month after the two-week shutdown are given in the table above.

LESS POWER USED

Power consumption has been less than for any of the other TVA furnaces. In the month after installation of the feed chutes it was 11 percent less than the average for these furnaces and about 16 percent less than results published recently.* The consumption of graphite electrodes per ton of P₂O₅ charged, has been about half as much as the consumption of carbon electrodes in the other furnaces. Since the cost of graphite is about twice that of carbon, the cost, based on the weights consumed, is about equal. However, lower handling costs and less breakage may favor the graphite electrodes. The difference in graphite and carbon consumption amounted to about 1 percent of the carbon used in the furnace charge. Therefore, with graphite electrodes, slightly more coke may be necessary

in the charge to obtain slag as low in P₂O₅. The slag from the initial operation averaged about 0.2 percent higher in P₂O₅ content than the slag from the other furnaces, but improvement was obtained recently through the use of a larger proportion of coke in the charge.

TAPHOLES

The furnace was operated for several weeks with complete rotation and use of all the tapholes. In recent operation the furnace was oscillated through 120 deg. and only one set of tapholes was used, primarily because it is less difficult to open a taphole that is used repeatedly than one that is not. However, with oscillation, there were instances when it was desirable to turn the furnace and to use one of the other tapholes. For example, the excessive accumulation of coke under one of the electrodes was corrected by turning the furnace and using the taphole that was near the electrode until the coke was removed. With the rotating furnace, it has not been necessary to rod the charge underneath the gas offtake to facilitate removal of gas. This is frequently necessary with stationary furnaces because of the accumulation of dust at this point. Operation has been dependable, and the furnace is being used as a regular production unit in the plant without the added cost of special or extra operating labor.

ROOM FOR IMPROVEMENT

With regard to determining the optimum conditions of operation and comparing results with and without rotation, much work remains to be done. Assuming that the best conditions for stationary operation can be estimated from past experience, it is still necessary to determine experimentally the best conditions for operation with rotation. Considerable progress has been made in this direction. The work, including tests with fines, will be continued insofar as possible without seriously interfering with phosphorus production. The results thus far are encouraging, and it appears that the advantages provided by rotation, justify the small added cost.

ACKNOWLEDGEMENT

The following made important contributions to this work: James Cox, W. H. Bundy, and S. A. Hardin of the Design Section; O. D. Crosby, E. C. Marks, and R. E. LeMay of the Phosphate Plant; and G. C. Hicks, H. M. McLeod, Jr., G. G. Patterson, D. W. Rindt, and J. A. Wilbanks of the Development Section.

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Save Time With Systematic Method for Distillation Calculations

Multicomponent distillation calculations, if rigorous, are extremely tedious, and many methods are of questionable accuracy. Here is a rigorous but systematic method designed to save you time.

J. W. DONNELL and KENNETH TURBIN

It has been very aptly stated by A. P. Colburn¹ that what the chemical engineering profession needs in multicomponent distillation calculation is: "either an exact solution, even though it is hard, or an approximate solution if it is easy." Any half way position as a general rule, sacrifices either accuracy or time and in many cases both. No doubt the best arrangement would be to have available both a short approximate method and a workable rigorous one. The short method could be used to orient the problem, e.g., give the economic relationship between the number of trays and the amount of reflux. In many cases where conditions are not critical the short method may be adequate. On the other hand the rigorous method is quite necessary under critical conditions, for example, in difficult separations or where extreme purity is required, as in some depropanizer operations. Here it is necessary to know such factors as concentrations and feed tray location.

A short method has been fairly well accomplished by correlation of actual plates and reflux ratios with minimum reflux and minimum plates. This is especially true since Underwood² developed an accurate method of obtaining minimum reflux ratios. A recent article³ using Underwood's minimum reflux method has presented a correlation that is simple and satisfactory. It also points out the limitations in this short method.

Now, if we look for a rigorous method of multicomponent tray calculations, we find that many of the rigorous methods offered are not only extremely long, but open to question of accuracy with respect to such matters as feed tray location and match-

ing of concentrations on trays above the feed with those below. Still others^{4,5} make the assumption that the distillation is carried out with a constant relative volatility (α), and practically all assume constant molal overflow from plate to plate. With these limitations in mind the following is a goal for a satisfactory rigorous method:

1. A rigorous method making few or no simplifying assumptions, with the possible exception of constant molal overflow and no appreciable heat loss to the surroundings.

2. An organized systematized method of computation to conserve as much working time as possible. Such a method, if possible, should be adaptable to a fully automatic calculator to conserve further working time.

3. A procedure simple enough that the method can be readily used by individuals who only occasionally have to make distillation calculations.

To avoid the troublesome matching of concentration at the feed tray and the questionable feed tray location it was decided to use the method of determining the separation that would be obtained from a given number of trays, feed concentration, feed tray location, and reflux ratio. This method would at first appear not to be as flexible as other methods in which the number of trays required to produce a given separation with a given reflux ratio is calculated. However, this objection is not valid since we have satisfactory short approximate methods available for determining the most economical number of plates and reflux to use⁶. There have been several who have approached the calculation as outlined, the most notable being Geddes⁷. They all fail, however, to outline a simple systematic procedure to follow after making the first approximation of tower temperatures.

Briefly, the procedure developed is as follows: (1) Make a preliminary estimate of quantity and analysis of distillate and residue, by assuming

that nothing heavier than the heavy key (specified permissible percentage of high-boiling compound allowed in distillate) will be contained in the distillate, or nothing lighter than the light key will exist in the residue. (2) Obtain top and bottom (boiling and dew points) tower temperatures from the approximate analysis obtained in the first step, and obtain the first estimate of tray temperatures by assuming an even temperature gradient from top to bottom of the tower. (3) By the use of material balance equations—equating the feed tray composition in terms of enriching trays' characters (liquid rates, vapor rates, equilibrium constants) to equations giving the feed tray composition in stripping tray characteristics—obtain a new and more accurate figure for the quantity of distillate. By these same equations find the approximate composition of not only the distillate but the liquid on each tray, and the amounts of all compounds on each tray. (4) Obtain new and more accurate tray temperatures, using the analysis obtained in Step (3). (5) Repeat Steps (3) and (4) until the tray temperatures used from Step (4) in a new Step (3) equal the tray

NOMENCLATURE

- A L/KV.
- B Moles of bottom product.
- D Moles of distillate.
- F Moles of feed.
- K y/x .
- L Moles of liquid leaving a plate.
- R Reflux ratio, L/D.
- S $1/A = KV/L$.
- V Moles of vapor leaving a plate.
- x Mole fraction of any component in liquid phase.
- y Mole fraction of any component in vapor phase.

Subscripts

- d Distillate.
- f Feed or feed tray.
- m Tray number in exhausting section, numbered in Roman numerals from still to feed tray.
- n Tray number in enriching section, numbered in Arabic numerals from condenser to feed tray.
- r Reflux.
- s Still.

J. W. DONNELL and KENNETH TURBIN are members of the Department of Chemical Engineering of Michigan State College, at East Lansing, Mich. Prof. Donnell's industrial experience has convinced him of the need for better methods for distillation calculations.

TABULAR METHOD FOR MULTICOMPONENT DISTILLATION CALCULATIONS AVOIDS ERRORS, SAVES TIME

1=X ₁	2	3=D	4=B	5=X ₅	6=KX	7=X ₇	8=Y ₈	9=Tray Temp	10a	10b
DATA P=100	$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	1-3		CALCULATE AS INDICATED STARTING WITH LIGHT KEY	K ₀ SELECTED AT P AND PROPER TEMP	CALCULATE AS INDICATED ENDING WITH HEAVY KEY	D ₁ /K SELECTED AT P AND PROPER TEMP	$T_1 = T_0 + \frac{M-N}{T_1 - T_2}$ $T_2 = T_0 + \frac{M-N}{T_1 - T_2}$	K AT TEMP T ₁ FOR TRAY I	K AT TEMP T ₂ FOR TRAY 2
C ₀ .15	R=2	.5435	.4565		242°	$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	.1108	T ₁ = 133°	2.49	2.08
C ₁ .15	V _M = C ₀					$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	.8706	T ₂ = 160°	1.02	1.51
C ₂ .25-6	C=1			$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	172°	$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	.5891	T ₃ = 177°	.79	1.02
C ₃ 100-X ₅	N=2			$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	237°	$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	.0857	T ₄ = 198°	.35	.49
C ₄ .15	M=2			$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	271°	$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	2.9162	T ₅ = 280°	.26	.26
C ₅ .20	k ₁ = .03			$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$	247°	$\frac{D_1(D_2-D_3)}{1-k_1-k_2}$		T ₆ = 245°	.13	.19
	k ₂ = .05									
10I	10X	10Y	10Z	11 & 11a	12a=A ₁	12b=A ₂	12i=S ₁	12x=S ₂	12y=S ₃	13=i(A
K AT TEMP T ₁ FOR FEED TRAY	K AT TEMP T ₂ FOR TRAY II	K AT TEMP T ₃ FOR TRAY I	K AT TEMP T ₄ FOR STILL	$\frac{L_1}{V_1} = \frac{R}{R+1}$	FOR TRAY I	FOR TRAY 2	FOR TRAY I	FOR TRAY II	FOR TRAY I	FOR TRAY I
177°	198°	220°	242°	.75	100	100	110	110	110	120
C ₀ 271	4.35	5.1	5.9	$\frac{L_1}{V_1} = \frac{R}{R+1}$	.301	.244	3.044	3.578	4.212	1.317
C ₁ 1.64	1.97	2.37	2.83		.735	.575	1.355	1.627	1.928	1.928
C ₂ 1.34	1.66	2.02	2.45	$\frac{L_1}{V_1} = \frac{R}{R+1}$	.949	.721	1.107	1.371	1.689	2.405
C ₃ .65	.84	1.06	1.30		2.145	1.531	.537	.694	.876	5.812
C ₄ .50	.67	.89	1.15		2.885	2.083	.413	.553	.785	9.078
C ₅ .26	.35	.47	.61		5.769	3.947	.215	.287	.381	27.717
14=i ₁ (A)	15=f ₁ (S)	16=f ₁ (S)	17=b	18=c	19=a+b	20=d	21=d-c	22=x ₁ c	23=x ₁ (d-c)	24=a+b+c
29	29	29	29	29	29	29	29	29	29	29
C ₀ .8734	1.9730	15.137	2.20	60.453	1.537	10.94.56	10.34.11	9.68.80	155.12	61.990
C ₁ .431	5.813	3.186	1.263	7.877	3.257	48.870	40.998	1.1816	6.107	11.134
C ₂ .684	4.657	2.881	2.052	5.157	4.457	24.823	9.665	1.2895	4.916	9.615
C ₃ 3.281	2.302	.609	9.943	1.236	15.655	1.678	.462	1.236	.0462	16.891
C ₄ 6.009	1.959	.406	18.027	.809	27.119	.7580	-.057	1.246	.0065	27.728
C ₅ 122.770	1.401	.112	68.310	.301	96.027	.05880	-.242	0.6020	.0080	96.328
25	26 & 26a	27	28	29	30=x ₁ d	31	32	33	34	35=x ₁
25	26 & 26a	27	28	29	30=x ₁ d	31	32	33	34	35=x ₁
C ₀ 1032.57	.541	92.987	32.537	335.249	2.770	1427	2.303	577.45	619.90	.00037
C ₁ 37.734	.4508	6.024	17.068	2.641	1429					

temperatures obtained from Step (3).

DERIVATION OF EQUATIONS

The equations referred to in Step (3) above are the heart of the whole method. They must be so arranged that they will allow a rapid convergence to the right answers as outlined in Step (5), but they must be simple and easy to use. The following derivation fulfills these demands. The principal nomenclature used in the derivation is listed in an accompanying table. Other nomenclature will be introduced as needed.

By a material balance for any component at the top of the tower

$$V_1 y_1 = L_1 x_1 + D x_d \quad (1)$$

Rearranging and introducing K_1

$$x_1 = x_d (L_1 + D) / V_1 K_1 \quad (2)$$

By a material balance around the top of the tower and between the first and the second tray

$$V_2 y_2 = L_2 x_2 + D x_d \quad (3)$$

Rearranging and introducing K_2

$$x_2 = \frac{V_2 K_2}{L_2} \left(x_1 - \frac{D x_d}{V_2 K_2} \right) \quad (4)$$

Combining Eqs. (2) and (4)

$$x_2 = \frac{D x_d}{V_2 K_2} \left(\frac{L_1}{V_1 K_1} + \frac{D L_1}{V_1 K_1 V_2 K_2} \right) + \frac{D L_1^2}{V_1 K_1 V_2 K_2} \quad (5)$$

By a material balance around the top of the tower and between the second and the third tray, and introducing K_3

$$x_3 = \frac{V_3 K_3}{L_3} \left(x_2 - \frac{D x_d}{L_3} \right) \quad (6)$$

Combining Eqs. (5) and (6)

$$\frac{V_3 K_3}{L_3} x_3 = \frac{D x_d}{L_3} \left(\frac{L_1}{V_1 K_1} + \frac{D x_d}{V_1 K_1} \right) + \frac{D L_1^2}{V_1 K_1 V_2 K_2} + x_d \left(\frac{L_1 L_2}{V_1 K_1 V_2 K_2} + \frac{D L_1}{V_1 K_1 V_2 K_2} \right)$$

or

$$\frac{x_3}{x_d} = \frac{D}{V_3 K_3} + \left(\frac{L_1}{V_1 K_1} \right) \left(\frac{D}{V_3 K_3} \right) + \left(\frac{L_1}{V_1 K_1} \right) \left(\frac{L_2}{V_2 K_2} \right) \left(\frac{D}{V_3 K_3} \right) + \left(\frac{L_1}{V_1 K_1} \right) \left(\frac{L_2}{V_2 K_2} \right) \left(\frac{D}{V_3 K_3} \right)$$

Rearranging and substituting A for L/KV and y_0 for $K_2 x_2$

$$y_3 = x_d [D(A_1 A_2 + A_1 + 1) + L_0 A_1 A_2]$$

Rewriting in general form

$$V_{n+1} y_{n+1} = x_d [D(A_1 A_2 \dots A_n + A_n + A_1 A_2 \dots A_n) + \dots + A_n + 1] + L_0 (A_1 A_2 \dots A_n) \quad (7)$$

For convenience these two functions of A will be designated as follows: $f_1(A) = A_1 A_2 \dots A_n + A_n A_0 \dots A_0 + 1$; and $f_2(A) = A_1 A_2 \dots A_n$. Eq. (7) is then written:

$$V_{n+1} y_{n+1} = x_d [D f_1(A) + L_0 f_2(A)] \quad (8)$$

By analogous fashion, making material balances around the bottom of the tower and using $S = KV/L$ instead of $A = L/KV$, we obtain:

$$L_{n+1} x_{n+1} = x_d [S_1 S_2 \dots S_n + S_0 S_1 \dots S_n + \dots + S_n + 1] + V_0 K_0 (S_1 S_2 \dots S_n)$$

Then defining $f_1(S) = S_1 S_2 \dots S_n + S_1 S_2 \dots S_n + \dots + S_n + 1$; and $f_2(S) = S_1 S_2 \dots S_n$, we can write for the bottom of the tower

$$L_{n+1} x_{n+1} = x_d [B f_1(S) + V_0 K_0 f_2(S)] \quad (9)$$

Since $Lx = Vy/S$, Eq. (9) can be rewritten:

$$V_{n+1} y_{n+1} = S_{n+1} x_d [B f_1(S) + V_0 K_0 f_2(S)] \quad (10)$$

Since $V_{n+1} y_{n+1}$ coming down from the top can represent the feed plate, and $V_{n+1} y_{n+1}$ coming up from the bottom can represent the feed plate, Eqs. (8) and (10) may be equated:

$$x_d [D f_1(A) + L_0 f_2(A)] = S_f x_d [B f_1(S) + V_0 K_0 f_2(S)] \quad (11)$$

The number of variables in Eq. (11) can be reduced since $L/V = R/(R+1)$ and $L_0 = L_n = RD$; $V_0 = D/(R+1)$; $B = 1-D$; and $V_n = CV_n$, where C is defined by the thermal condition of the feed. $C = 1$ when feed is liquid at its boiling point. Eq. (11) may now be written:

$$x_d [D f_1(A) + R D f_2(A)] = S_f x_d [(1-D) f_1(S) + C D (R+1) K_0 f_2(S)]$$

or

$$x_d [D f_1(A) + R D f_2(A)] = x_d [S_f f_1(S) + D C (R+1) K_0 f_2(S) S_f - S_f f_1(S)] \quad (12)$$

Substituting $(x_1 - x_d D)/(1-D)$ for x_2 and solving for x_2

$$x_2 = [x_d S_f f_1(S) + x_d [C(R+1) K_0 S_f f_2(S) - S_f f_1(S) D] + [f_1(A) + R f_2(A) + S_f f_1(S) D + C(R+1) K_0 S_f f_2(S) - (S_f f_1(S) + f_1(A) + R f_2(A)) D] \quad (13)$$

For simplification let $a = f_1(A)$, $b = R f_2(A)$, $c = S_f f_1(S)$ and $d = (R+1) C K_0 S_f f_2(S)$. Then Eq. (13) becomes:

$$x_2 = \frac{x_d (a + b + c) D + d - (a + b + c) D^2}{(a + b + c) D + d - (a + b + c) D^2} \quad (14)$$

Where determination of x_2 is not possible by a material balance from the equation $x_2 = (x_1 - x_d D)/(1-D)$, due to the small difference between x_1 and $x_d D$, the following equation may be used which is derived from Eq. (12):

$$x_2 = \frac{x_d D(a + b)}{c + D(d - c)} \quad (15)$$

From Eq. (1) it can be seen that the amount of any component on the top plate is given by the equation $(Lx)_1 = A_1 D x_d (R+1)$, while below the top plate and on to the feed plate the following series of equations give the amount of any component on the plate:

$$(Lx)_2 = A_2 [(Lx)_1 + D x_d] \quad (15)$$

$$(Lx)_3 = A_3 [(Lx)_2 + D x_d] \quad (15a)$$

$$(Lx)_4 = A_4 [(Lx)_3 + D x_d] \quad (15b)$$

$$(Lx)_{n+1} = A_{n+1} [(Lx)_n + D x_d] \quad (15c)$$

Similarly, below the feed tray, the following series gives the amount of any component on any plate.

$$(Lx)_1 = 1/S_1 [(Lx)_2 + B x_d] \quad (16)$$

$$(Lx)_2 = 1/S_2 [(Lx)_3 + B x_d] \quad (16a)$$

$$(Lx)_3 = 1/S_3 [(Lx)_4 + B x_d] \quad (16b)$$

$$(Lx)_n = 1/S_n [(Lx)_{n+1} + B x_d] \quad (16c)$$

The amount of any component on the feed tray is given by the equation:

$$(Lx)_f = 1/S_f [(Lx)_n + D x_d] \quad (17)$$

where n is the plate above the feed plate.

USE OF WORKING EQUATIONS

Although a fully systematized working table using the various equations in accordance with the five operational steps outlined above is given in this article, it is well to describe a little more in detail the use of the equations.

Steps (1) and (2), namely: (1) preliminary estimate and analysis of distillate and residue, and (2) estimate of tower temperatures, need no further clarification. In step (3), Eq. (13a) is used to determine the new and better estimate of the quantity of distillate D . It is evident that the equation $\Sigma x_d = 1$ for the various components must be satisfied and this is done by selecting D , such that the equation will be satisfied. Although Eq. (13a) may look formidable as a time consumer, an examination of the working table shows that such items as $f_1(A)$ and $f_2(S)$ can be calculated by simple multiplication of each successive A or S value by the preceding A or S value increased by the numeral one. The $f_1(A)$ and $f_2(S)$ are obtained by merely multiplying each succeeding A or S value by the preceding one. Step (4) consists of determining the approximate analysis on each tray by means of Eqs. (13), (14), (15), (16) and (17). This procedure is quite simple owing to the table arrangement, the analysis of one plate following directly from the previous one. The new tray temperature estimates are obtained from the tray analysis when a temperature is found that allows $\Sigma Kx = 1$. Step (5) needs no explanation since it is a repetition of Steps (3) and (4) after new and more accurate figures have been obtained from the previous Steps (3) and (4).

HOW TABLE IS ARRANGED

This table has been so arranged that one calculation follows another

without the use of engineering judgment or the necessity of having to realize what each step represents. By this procedure much time is saved and errors avoided. Columns 1 and 2 give the data for the problem. Lines headed $C_a, C_b, C_c, C_d, C_e, C_f, \dots, C$ represent compounds in the system and all column headings refer to calculations involving each compound, except the column headings marked with an asterisk. In these cases the calculations refer to plates. Column subscript small letters refer to plates and are used so that the number of plates can be increased or decreased while the column references to other columns still remain valid. The headings in Columns 13, 14, 15, and 16 are for this particular problem. In general form they are as follows:

$$\text{Col. 13} = f_1(A) \left[\left(\frac{f_2}{f_3} + 1 \right) \left(\frac{f_4}{f_5} + \frac{f_6}{f_7} \right) \left(\frac{f_8}{f_9} + 1 \right) \right]$$

$$\text{Col. 14} = f_1(A) \left(\frac{f_2}{f_3} \right) \left(\frac{f_4}{f_5} \right) \left(\frac{f_6}{f_7} \right) \left(\frac{f_8}{f_9} \right)$$

$$\text{Col. 15} = f_1(S) \left[\left(\frac{f_2}{f_3} + 1 \right) \left(\frac{f_4}{f_5} + \frac{f_6}{f_7} \right) \left(\frac{f_8}{f_9} + 1 \right) \right]$$

$$\text{Col. 16} = f_1(S) \left(\frac{f_2}{f_3} \right) \left(\frac{f_4}{f_5} \right) \left(\frac{f_6}{f_7} \right) \left(\frac{f_8}{f_9} \right)$$

Whenever a column is followed by an equation indicating that the sum must equal unity, there is a trial-and-error calculation involved. This is the case with boiling points, and the trial and error for a new quantity of distillate in Columns 26 to 30 inclusive. Columns 6, 8, and 10a to 10z inclusive indicate that the K values must be taken from K charts at the given tower pressure and the temperature as indicated. This table has the first trial calculation of a problem as given in Columns 1 and 2. The new trial starts with Column 10a and three more trials were necessary before the temperature shown in Columns 40a to 40z inclusive, and the value of D in Column 26, coincided with those used in the previous trial, thus indicating the correct answers. This working table can be easily set up with only a slight modification when a partial condenser is used. The data showing m as 3 includes the feed plate.

It will be observed that one cannot exactly specify the amount of heavy key in the distillate in a rigorous treatment, but as long as the separations of the key components are fairly sharp the initial specifications are fairly close to the calculated ones.

This method is so organized that an engineer who has not had the time to carry out calculations recently can immediately carry out a rigorous distillation calculation without the need of reviewing distillation calculations. Or he can easily direct some non-technical person to carry out such calculations accurately. The table is

so set up that it could be adapted without need of engineering judgment and skill to automatic calculating machines. The authors are now engaged in an attempt to make such an adaptation.

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PROTECTION AGAINST BOMBS

(Continued from page 107)

tegrated process industry like an oil refinery, stoppage will be immediate and complete. Experience indicates that utility failures are general and that disaster plans should contemplate the immediate loss of all electric power, water, steam, and gas.

The environment of plants, whether rural or urban, is of little importance in protecting them from air attack—except that plants on bends of rivers or on peninsulas and similar sites easily recognizable from the air are easier to pick out. In cases where atomic bombs are dropped, plants in small valleys or separated by mountains possess this advantage that the area of destruction is confined. The half of Nagasaki which was not in the valley where the bomb fell was unharmed.

The conclusion of the Oil Division personnel was that the most satisfactory defense against aerial bombing was by the prevention of attack. In view of this conclusion, except in a few special cases, it does not seem justifiable at this time to prepare to adopt on a wide scale any of the air raid protective measures which were found partially effective by the Germans. These included such devices as smoke screens, blast walls, decoy plants, and camouflage. On the other hand, personnel training to guard against disasters is definitely in order. The emergency shutdown procedures which are normal operating procedures should be expanded to take account of situations where no utilities are available.

In this connection it should be remembered that our bombing accuracy was low, with less than 10 percent of the bombs dropped falling within plants. It is unlikely that any enemy would be more accurate. Also it is

likely that enemy atomic bombs will be too scarce to drop anywhere except in large cities.

Finally, study should be given to the development of personnel shelters for protection against flying fragments and against blast. Small shelters for a few people each, situated directly in the working areas, can be constructed at small cost, with little need for critical materials. Such shelters will supply protection against all but direct hits and appear to be much more practical than the large, heavily constructed shelters for numerous people. As a morale factor they should prove an excellent investment.

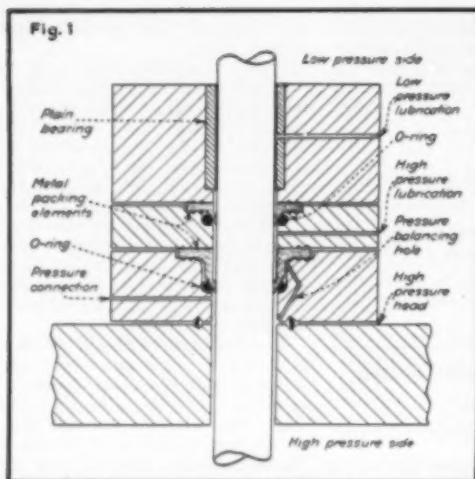
It is justifiable to expend considerable effort to guard against fire, especially to make provision against its spreading. This is particularly true where there are tanks and tank farms storing large quantities of volatile or flammable liquids. (See especially the Report on Designed Fire Prevention, *Chem. Eng.*, June 1951, pp. 125-34.—Editor.) More damage resulted from fires started by air raids in Germany and Japan than from any other cause. Fires started by the atomic bomb destroyed Hiroshima. More people burned to death in the first large incendiary bomb attack on Tokyo than perished in Hiroshima.

Blackouts make locating targets difficult for plane pilots. When not too expensive and in cases of vitally important plants, they should be available.

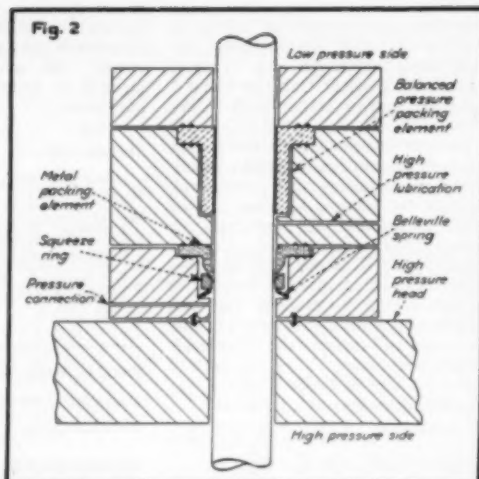
To install elaborate precautionary measures on a large scale would diffuse the country's productive capacity. In a situation where there is no completely effective protection against falling bombs, the first step is to build strength which will discourage attempts at bombing attacks. The second step is to develop means for the detection and destruction of enemy aircraft before they can accomplish their missions.

In special cases where a vital commodity happens to be highly concentrated (tetraethyl lead, for example) some expenditures for protection are in order. This should include blackouts, camouflage, fairly elaborate fire protection, and possibly even some protection of vital units of equipment which would be difficult to repair or replace now. Large transformers, large generators, special compressors, prime movers, as well as other large units of mechanical equipment fall into this last named class.

Although this is a subject in a slightly different category, protection of our plants from sabotage may be of paramount importance to defend us from the aggressor we now face.



SHAFT SEAL depends upon the introduction of lubricant at process pressure between two packing rings.



SECRET OF SUCCESS is balanced pressure across the lower packing element. Note balancing hole in spring.

How to Seal Rotating Shafts Against High Pressures

WALTER COOPEY

One of the most difficult problems associated with the practical application of high pressures is that of sealing rotating shafts against leakage. The most common method used to seal rotating shafts, of course, is the use of soft or plastic packings in a conventional stuffing box. Even at relatively low pressures, however, this method is a constant source of trouble. No matter how carefully you install and adjust the packing, you usually end up with a scored shaft and a leaky seal.

In general, there are two approaches to the high pressure shaft seal problem—you can use rigid construction with very close clearances, or you can apply flexibility to various elements of the design to compensate for the variables that exist. Or you can compromise with a combination of the two methods.

In the case of rigid construction, precision work is essential. While generally satisfactory for laboratory or small-scale units, this method involves certain difficulties which increase in magnitude as you go to large-scale, commercial equipment. These difficulties result from stresses imposed by the unfavorable effects of high pressures, high temperatures, and misalignment. If, however, you can compensate for these effects, you have considerably narrowed the scope of the problem.

In most process operations the fluids do not have good lubricating properties. This means that application of the close clearance method of sealing is impractical unless you provide a supply of lubricant at a pressure equal to the process pressure.

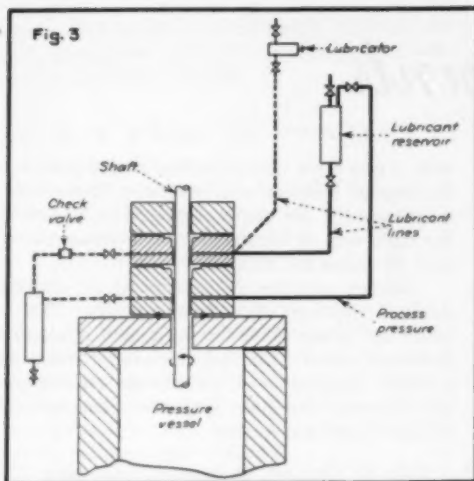
WALTER COOPEY, before his recent retirement, spent 33 years with Du Pont. Most of his experience has dealt with processes operating at pressures between 5,000 and 20,000 psi. He is now living in Charleston, W. Va.

Although this idea can be made to work under certain fixed conditions, there are a number of problems which you must consider in design of a suitable seal. Some of these are:

1. Precision workmanship within tens of thousandths of an inch is necessary to obtain the required clearances.
2. Running clearances will be different after the pressure of the lubricant and the process have been applied.
3. If the process is operated at elevated temperatures, conduction of heat will introduce expansion problems in the stuffing box.
4. Shearing action in the oil film develops heat which may have to be removed by a cooling medium. Otherwise it may give rise to the temperature effect just mentioned or may reduce the viscosity of the lubricant to such an extent that it will not seal satisfactorily.
5. Selection of the proper lubricant must be based not only on its viscosity under operating conditions but also on its possible effect on the process. Since an appreciable quantity of the lubricant will pass into the pressure vessel being sealed it must not be a contaminant for the reaction.
6. Because of the variables involved, it is impossible to calculate with any degree of accuracy the conditions under which the seal will operate.

The two rotary seals described herein were designed to overcome, as far as possible, these difficulties. They both involve the introduction of lubricant at process pressure between a pair of sealing elements.

This can be done in two ways (Fig. 3). The solid line diagram shows a lubricant reservoir connected to the seal at two points. Process pressure from the lower tap is imposed on the lubricant in the reservoir, forcing it into the upper tap at this pressure. The lower element is thus at balanced pressure, and there will be no flow of fluid



LUBRICANT is forced into seal either by process pressure (solid lines) or by an external lubricator (dotted lines).

across it in either direction. The upper element, obviously, is subjected to full process pressure.

In the broken line arrangement, a high pressure lubricator forces lubricant between the packing elements. A high pressure reservoir catches the lubricant in excess of that necessary to maintain balanced pressure. Modifications of these schemes can be used but, in general, the solid line arrangement is more suitable for use with the type of seal shown in Fig. 1 and the alternate method with that of Fig. 2.

Let us now examine the mechanical details of the seals themselves, as shown in Figs. 1 and 2. They both use a metal packing element for the lower seal. This element may be made of silver, bronze, or any other metal or alloy which has suitable anti-friction properties. Because of the negligible pressure differential across the element, you could even use a plastic material.

The only difference between the two designs as far as the lower element is concerned is that Fig. 1 shows an O-ring and Fig. 2 shows a Belleville cone-shaped spring and squeeze ring combination. Although the Belleville spring has the advantage of compactness, a helical spring or any other type that will produce the same results can be used.

In either case, their purpose is to maintain lip contact of the packing element with the shaft. If the lip of the packing is formed to provide only line contact, wear will be negligible.

A hole in the lower packing retainer (Fig. 1) or a small hole through the spring (Fig. 2) permits pressure equalization across the lower element. In Fig. 2 a small groove across the spring seat would serve the same purpose. As a result of this balanced pressure across the lower element, it is necessary to retain only the lubricant pressure, which is relatively easy.

The two designs of lower seal elements are based on the same principle and differ only in the method used to maintain contact of the packing with the shaft. They can be used interchangeably.

The upper element of Fig. 1 is designed on the Bridgman "unsupported area" principle. In this principle the pressure to be sealed acts on a packing through an area greater than the area of the packing itself. Thus the pres-

sure developed in the packing is always higher than the internal or process pressure, and up to a certain point, the joint can not leak.

The O-ring in the upper element provides the initial lip contact of the packing with the shaft. After pressure is developed by the lubricant, contact is retained by the unsupported area or unbalanced pressure effect. Clearance above the O-ring must be at a minimum, or else the ring material will be forced into it and lose some of its effectiveness. The ring, because of its resilient nature, transmits the pressure to the packing element.

With a close initial fit of the packing on the shaft, the O-ring would be unnecessary. Its use provides compensation for any wear that may take place. Such wear should occur very slowly, since the rubbing surfaces are well lubricated. After interruptions in operation, however, it would be difficult, without some means of adjustment, to build up sufficient pressure with the small flow of lubricant available to effect sealing between the lip of the packing and the shaft.

The material of which the O-ring is made determines the maximum temperature at which the packing can be operated. The temperature effect can, however, be minimized by increasing the distance between the pressure vessel and the packing or by using some method of cooling.

The plain bearing shown above the packing provides alignment in the assembly. It is lubricated from a low-pressure source. If only one set of packing is used, a thrust bearing is required. It would have to be large enough to take the total pressure load over the cross-section of the shaft. If the shaft extends through both ends of the vessel and is packed at each end, then there is no need for a thrust bearing.

The upper packing element of Fig. 2 is a balanced pressure sleeve or bushing which acts both as a packing and a bearing. The clearance around the outside of the bushing allows the same pressure to exist on both sides of the wall of the bushing. This means that the clearance between the bushing and the shaft will remain essentially constant in spite of variations in pressure.

The clearance should be made a close running fit so that the pressure drop of the lubricant film across the length of the bushing balances the operating pressure. The amount of lubricant leakage will depend upon the clearance that is used and the operating pressure maintained.

Advantages of these seals are simplicity, low cost, wide choice in lubricants, protection of the process against contamination, and minimum lubricant consumption.

You may wonder, as we did, just how to apply Mr. Cooney's ideas to dimensional design of a seal for a particular problem. Here are the author's comments:

"The design would be based pretty much on know-how and judgment. Aside from figuring for the pressure-sustaining portion of the unit, there are too many variables to make use of any calculations. The answer would be only as good as the assumptions.

"In fact, I have never seen a formula for the most simple type of packing installation. To give you an idea of the divergency of designs used to solve problems of this sort—I know of packing applications which have as many as 25 rings of metallic packing where 3 or 4 rings would serve the purpose better. An explanation of this would make a long story."

As is true in so many engineering problems, there is no adequate substitute for experience.

Editorial Viewpoints

More Billions for Defense

Here's a recap on defense expenditures. Draw your own interpretation of what the figures mean to your business. The longer term pattern of the Wilson plan is to spend an average of \$50 billion a year for the next three years. The crest of \$55-60 billion will be reached in late 1952, followed by gradual decline to a level around \$35-40 billion.

Where's the money going? National defense, which includes all expenditures for the armed forces and the stockpiling of strategic materials, presently takes 92 percent of the total. Mutual defense assistance (aid to our allies) is now but 4 percent but will mount to \$7.5 billion for fiscal 1952. The atomic energy program has been stepped up 85 percent, to \$1.3 billions, to provide for the new construction projects, as well as research on nuclear reactors.

Barring a sudden extension of hostilities, it looks as though the present program will keep rolling at only a gradually increasing speed. Most gains will be made by aircraft, artillery, weapons, ammunition, guided missiles and electronics. These will take metals and some other basic raw materials from process industries, but the gradual withdrawal should precipitate no crisis. Nor are there grounds for any fear of a general business recession in the post-emergency period. In short, the stage is set provided something doesn't happen internationally to upset it.

Plant Dispersal Pays Off

Visitors in the neighborhood of New Brunswick, N. J., often remark about the campus-like beauty of the various Johnson & Johnson enterprises. Plants are laid out to take maximum advantage of the rolling, wooded countryside. We have seen similar settings for other industries, notably in southern California. All have been planned for peacetime operations. But today plant dispersal takes on new and serious significance. The threat of bombing is indeed a current danger. If war comes, proper plant dispersal will pay big dividends.

Because there may be much for all of us to learn from German and Japanese experience in World War II, we have asked two team leaders of the U.S. Strategic Bombing Survey to prepare a special report for *Chemical Engineering* readers. Their article which will be found elsewhere in this issue, drives home many facts that will help any plant to survive an air attack. It introduces a new dimension in considering plant sites. Distance between units should be great enough to prevent the spread of fires from bursting bombs. Terrain features, such as gullies or ravines, can often be

used to give better blast protection to vital plant units. Bomb-proof buildings are, of course, impractical in most instances, but proper placing of equipment and the right sort of foundations can minimize damage from all except the direct hits.

Military units always make use of the dispersion factor in deploying their fighting forces. "Do not bunch up" is one of the first basic ideas driven home to the raw recruit. Certainly chemical engineers with a realistic appreciation of the strategic importance of their industries can often apply these same principles to plant layout and location.

New Patent Policy Fixed

A new set of regulations regarding patents obtained or obtainable as a result of inventions made by Government employees has just been issued, with Presidential approval, by Chairman Archie M. Palmer of the Government Patents Board. Under the auspicious title, "Rules and Regulations for the Administration of a Uniform Patent Policy with Respect to the Domestic Rights in Inventions made by Government Employees," the first step has been taken toward a clean-cut arrangement for handling these controversial inventions.

The rules as first issued leave several wide gaps in the program. There are a number of reasons for that fact. In the first place it has been practically impossible to get unanimous agreement on these points among interested government agencies, the former policies of which were very diverse. In the second place there are some actual uncertainties as to how any effective policy can be worked out. It was deemed better, therefore, to set up a general framework in these rules and allow the handling of individual cases to develop a pattern for filling the gaps and eliminating the uncertainties.

In their present form, the rules represent a long step toward a sound basis for the relations between government, on the one hand, and outside inventors and industry on the other. Any disappointment, because the first rules are not complete, is fully offset by the assurances from Dr. Palmer that revisions will be made and all details worked out as promptly as experience permits.

For many years we have been disturbed about the variations in government practice, some of which permit certain private patent ownership of inventions obtained at taxpayers expense. Obviously this was altogether unfair for industrial research groups and individual inventors. But now it looks as though we are on the way toward elimination of all such unde-

sirable practices. Certainly Dr. Palmer deserves our congratulations for the progress already made and our cordial cooperation in his effort to perfect the rules and administer them soundly.

How We'd Amend The Food Law

Proceedings of the Delaney Committee have dragged along for ten months. Appraisal of its progress is somewhat difficult because so little that is new has been presented. There are a number of points, however, worth thoughtful consideration by chemical executives:

1. Department of Agriculture officials have proved convincingly that extensive use of chemicals for pest control is essential else Americans will go hungry and ill-clothed for want of agricultural output. This means that the spray-residue problem is likely to continue indefinitely and to affect more and more crops with respect to more and more chemicals.

2. Deliberate addition of chemicals to food is shown clearly to improve palatability, economy of manufacture, and shelf life in many cases. There appears to be no evidence whatsoever that anyone ever died, or was even harmed dietetically by such chemical additions. Even the zealots have produced no real evidence that there is even a single new exhibit in their "chamber of horrors."

3. Demand for more authority by the Food and Drug Administration continues. No one disputes the need for ample authority, but most listeners fail to find evidence that any new feature of the law would make it either more certain or more economical for F&DA to insure the maximum of protection to the public.

4. American chemical enterprise has evidently been sufficiently careful to avoid any threat to public health through either unwarranted pest-control methods or dangerous additions of chemicals to foods. But it is rightly argued that this does not prove that there never will be unfortunate incidents in the future. Perhaps this justifiably leads to the following suggestion for useful legislation:

Chemical Engineering believes that the Commissioner of F&DA and his staff are fully justified in asking that they have notice of plans for the use of new chemicals to be introduced into foods. They already have this for new pest-control chemicals since they are consulted regarding such matters whenever a registration of pesticides in the Department of Agriculture may become a factor of significance on food.

It does not seem necessary to set up a new bureaucratic procedure in order to give due notice to F&DA. We believe that a simple registration of the intention to use new chemicals in foods and beverages will suffice. It is obvious that any such notice which is not adequately supported by persuasive evidence should also permit a veto of plans by the commissioner if he feels

that any public hazard may exist. He probably has that authority already, but it would be well to spell it out in new legislation when the requirement of registration is added to the law. We believe that one bit of new authority will suffice.

We would not oppose still another legislative proposal which was brought before the Delaney Committee by spokesmen of the National Grange. This proposal contemplates the establishment of a "National Pesticide Commission" of one scientist each from Agriculture Research Administration, Public Health Service and Food and Drug Administration. Such a board would provide convenient machinery for carrying out the present law, which authorizes the fixing of tolerances for unavoidable spray residues. Since three important points of view would be represented, it is likely that decisions by such a board would be fairly well considered and probably generally accepted.

But we look upon this as a procedural matter and not a question of new authority. We hope that the cooperative spirit which already exists among the three agencies may accomplish the intended result. Certainly, many pest-control chemicals are being penalized from the lack of knowledge by their makers as to what uses and residues are officially permissible. The important thing, therefore, is not to establish new authority, but to make present authority function either through more prompt action or by better coordination of interested agencies.

Altogether the Delaney Committee proceedings have been more time-consuming than really troublesome. Indeed, chemical enterprise can take considerable satisfaction from the fact that after all these many months there is no real evidence that the chemical industry is neglecting its responsibility for proper consideration of public health and welfare.

Hail the Chief

General "Tony" McAuliffe's stint with the Chemical Corps was all too short. But he accomplished a lot in 21 months, both within the organization itself and in its relations with the higher commands. As a fighting man he recognized chemical warfare as a fighting force that must be reckoned with in any future military emergency. He also recognized the fact that anything that affects chemical industry affects our national security. Therefore, he did much to bring together the best thinking and planning of industrial as well as military strategists.

We shall miss his colorful, energetic leadership. But the Army Chemical Corps is fortunate in its selection of a new chief, Major General E. F. Bullene. Prior to serving as McAuliffe's deputy, he commanded the Army Chemical Center at Edgewood Arsenal, and knows every phase of his new responsibilities. Under his leadership the Chemical Corps will continue to grow in importance and influence.

Getting the Most Out of Your Safety Engineer

If you call him into conferences when you are planning new processes or changing old ones, he can save you lots of trouble and expense later on.

ALLEN L. COBB

Safety is one of the man factors which has to be considered in the selection and development of new processes or the improvement of older ones.

Naturally, first considerations must be given to the chemical and economic practicability of the process, for no process is going to be adopted unless it is chemically practicable and economically advantageous.

But safety can sometimes be a determining factor in the selection of a new process—obviously no process is going to be either chemically practical or economically sound if it is going to be plagued with a series of explosions and fires.

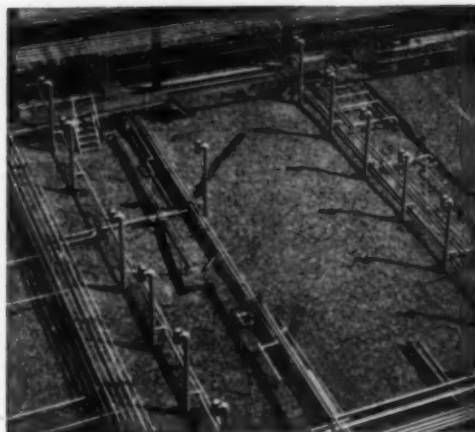
CALL HIM IN EARLY

In many chemical plants, safety factors aren't considered until processes have been selected and equipment layout and design determined. Then the safety engineer is called into discussions to take care of fire and explosion hazards and safety to personnel.

In many instances this works well; in others, the recommendations of the safety engineer may make it necessary to redesign the equipment or, in extreme cases, to reconsider the process selection.

By this time a considerable amount of work may have been put into the project and the design frozen so that desirable improvements are impractical. Bringing the safety engineer

ALLEN L. COBB is a licensed professional engineer and safety director, Kodak Park Works, Eastman Kodak Co., Rochester, N. Y.



HE MAY SUGGEST BURIED TANKS such as in this tank farm, each with conservation vent and flame arrestor or . . .

into the discussion at an earlier point may often result in reduced cost and considerable time saving in the design stage.

One approach, unfortunately all too common, is to delay calling in the safety engineer except for various little guards and gadgets, until that moment when the smoke of an explosion drifts into the skies and its echoes still rumble in the distant hills.

Then under pressure and in the midst of all the confusion that such a scene presents he will start asking the familiar and searching questions. What arrangements were made to take up the heat of an exothermic action? What were the temperature controls? What was the catalyst? What side reactions may occur? What provisions had been made to prevent the entrance of air? What is the effect of impurities? Was this reaction tested in a pilot plant or did it jump suddenly from laboratory to full plant size? Were there any changes in raw materials during operation? Should this operation have been under inert gas? Should it have been under vacuum? Did you find the instrument charts? These and many other questions until the answer is painfully brought to light, and the decision finally made not to do things that way again.

Why not ask these questions in the beginning? The alert safety engineer probably is not as well qualified in chemistry as any other man who will sit around that board, but he will have a certain detailed knowledge growing out of his own experience and assignment which relates particularly to the possibility of fire and explosion, the

production of poisonous gases in quantity, or severe hazards to personnel from the eruption of corrosive materials.

LET HIM MAKE RECOMMENDATIONS

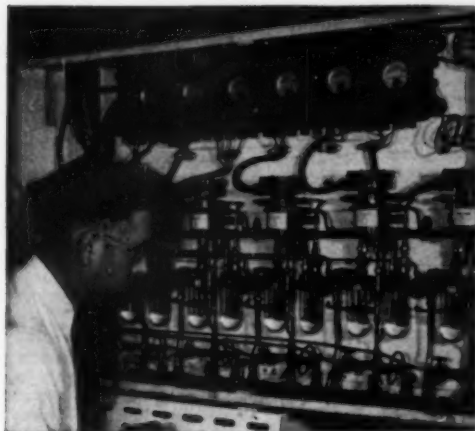
While, in general, the questions the safety man asks will bear upon methods and details, he may occasionally suggest a fundamental change in the process itself.

For example, one industrial operation which in pilot plant stage produced large quantities of hydrogen cyanide was completely changed as a result of the questions asked by both the safety man and the industrial toxicologist to an entirely different process which did not evolve the hydrogen cyanide, obviously a much better and also cheaper method of control than the provision of elaborate ventilating equipment, gas alarms, and so on.

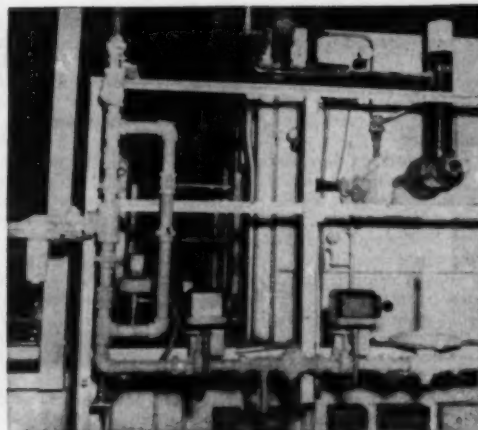
Another process involved the handling of large quantities of metallic sodium. Research prompted by the safety man brought out a new process which eliminated metallic sodium, doing away not only with the hazard but with the cost of the special building and equipment necessary to house this particular operation.

Consideration of the relative hazards of gas phase vs. liquid phase operation in another process resulted in development of a new method which greatly reduced the toxic gas hazards. In this case the development work was actually done by the safety man, a well-qualified chemical engineer.

This, however, is not the usual procedure. Rather, the safety man will ask questions—familiar and simple for



CONTINUOUS CHECKING of vapor concentration and automatic shutdown when approaching explosive range, or . . .



OVEN SAFEGUARDS such as safety shutoff valves, gas line vaporstat, flame rod, pressure regulators, and flame detector.

the most part—but questions which are fundamental to safe operation of the plant.

The following are rather typical questions more or less routine in the ordinary investigation of the hazards of any chemical operation.

If we are using flammable solvents? Will the solvent be a low-boiler with a low flash point? Could a high-boiler with higher flash point be used to advantage?

Will the atmosphere within equipment be above or below the explosive range and is there any possibility of changing either the solvent or the temperature to prevent operation too close to the explosive range?

Are we using a dry or a water-miscible solvent? Perhaps we have equipment operating near the explosive range with very dry air where the possibility of static generation is appreciable and there is the possibility of substitution of a solvent which will present a lesser degree of the static hazard.

Is the reaction exothermic? If so, will we be able to control temperatures in large scale equipment?

Are we going to use batch or continuous operation? Would there be any advantages from the temperature control point of view in using continuous equipment with the reaction taking place within tubes instead of large volume mixers, with resulting better cooling?

If we are to use a catalyst, is it an active material which may heat spontaneously or form unstable compounds? Is the catalyst to be reactivated and are there any hazards in this operation?

What possibility is there for the development of unstable compounds, peroxides, perchlorates, acetylides and so on?

Are any of the intermediates azo or nitroso compounds?

What is the oxygen balance?

Have we a dust explosion hazard? Can this be reduced by operating in an inert atmosphere? Could some of the operations be performed in a wet instead of a dry process?

Are toxic materials used or produced and what opportunity will there be for leakage or spills? Have we adequate methods of detecting dangerous concentrations?

Is there a possibility of an improper reaction with the evolution of toxic materials in large volume? If so, can we provide adequate methods of absorbing such materials?

Will anything in the process react violently with water?

What pressures are involved? What explosion relief devices are needed and what possibility of the vents being clogged, valves stuck, bursting discs corroded, and so on?

This, of course, could go on. These are only samples of what the safety man will have in mind.

BE SURE HE IS QUALIFIED

It is obvious that such a list presupposes some chemical knowledge on the part of the safety man, some knowledge of mechanical equipment, some knowledge of fire protection devices and methods, and indicates the necessity for an engineering background.

Here we come upon the unfortunate fact that the safety man in

many plants may not be properly qualified for his job. Perhaps in a small plant with only the relatively simple hazards of machine shop operations, engineering background is not necessary and the shop handyman may be entirely adequate. However, he is not an engineer and should not be so designated.

In the chemical industry—with its multiplicity of problems—there is much greater need of technical background, and we may reasonably expect our chemical plant safety engineer to have a technical college background and sufficient experience in his particular branch of engineering to qualify him as a professional engineer as, indeed, he should if he is to bear that title in the organization.

These few examples taken from actual experience indicate some of the types of processes in which the suggestions of the safety engineer have been helpful.

The solvent storage area of Kodak Park (above) presents a relatively simple problem—handling of materials rather than chemical operations—that deserve careful attention from the fire and safety standpoint, attention which demands the particular kind of information with which your safety engineer is equipped. Note in this instance the buried tanks, each with conservation vent and flame arrestor, the fixed piping system extending over a mile into operating units of the plant.

The safety engineer knows his vent valves, the control equipment needed at discharge points, methods of shutting off pumps in an emergency, and the proper fire extinguishing methods for various liquids involved.

The chemical safety man is, or ought to be, familiar with instrumentation such as flammable vapor indicators, oxygen indicators, and gas detectors of various kinds. He is familiar with their limitations, costs, and particular tricky features.

Now consider a film casting department at Kodak Park. These machines are connected to solvent recovery systems and are equipped with gas analyzing equipment shown above which automatically puts the machine on outside recirculation if the vapor concentration within the machine should approach the explosive range.

The particular instruments used were not selected by the safety man. They were chosen after much careful study by many technical people, but in both original selection and subsequent development the suggestions of the safety engineer have always been welcomed.

The qualified chemical safety man knows when it is safe to use fuel-fired equipment in ovens and dryers and what safety devices are needed to secure adequate ventilation and to maintain security of ignition. The oven safeguards used on ovens today such as those shown above are an interesting example of the actual development by fire protection engineers of devices—including the flame detector—that rely upon the electrical conductivity of the flame itself.

These, of course, are not strictly chemical problems. Somewhat more typical of the chemical plant problem would be the use of isopropyl ether. The chemical safety man is familiar with the formation of ether peroxides, safe limits of peroxide content, methods of prevention, and the safe handling and disposition of ethers which may have become contaminated in this manner.

Other operations may involve materials which ignite spontaneously on contact with air. Safety men in connection with chemical engineers have worked out handling methods and containers for such materials, with all operations including the connection of pipelines to containers, accomplished in a nitrogen atmosphere. When emergencies have developed, the safety man has been called in to directly solve the spontaneous ignition problem in the field.

Sometimes a tray drying operation is planned. Your safety man may surprise you by suggesting a low flash solvent so that primary evaporation will take place in the centrifuge—thus reducing the possibility of building up a high vapor concentration in the dryer.

There is a great deal of mechani-

cal equipment in a chemical plant. Your safety man is actually probably a mechanical rather than a chemical engineer. He will be familiar with pressure vessels, relief equipment, liquid level measurement, filters of various types, conveyors, blenders, ball mills, and all the familiar machinery of the chemical plant. He may be able to help in your decision whether to filter or centrifuge or in the selection of the type of mixer.

In the selection of mixers, in particular, turbine mixers have been substituted for fluke mixers where there was a possibility of frictional heating of material caught between the flukes and the sidewalls of the mixer.

Rubber mills, blenders, and many types of mixers all present serious hazards to personnel. In this field the safety engineer will be familiar with methods of automatically loading and dumping equipment to avoid the hazards of manual handling; it has been found that these methods sometimes improve efficiency as well as eliminate serious hazards to persons.

When it comes to the selection of a solvent to replace one which may be toxic, there is often a wide choice. In certain operations it may prove advantageous, for example, to use xylene in place of benzene because of its lesser volatility. Halogenated solvents vary very widely in toxicity, and there is often room for choice where the safety engineer's suggestions may be

of value. His familiarity with ventilation also may be of considerable assistance in the design phases of the development.

Finally, your safety man has become familiar with many of your most tricky chemicals through the medium of a most unpleasant task: the disposal of unwanted, decomposed, unstable, unsafe, and explosive chemicals. In certain explosive plant operations the safety engineer is in direct control of the disposition of all explosive wastes, the decontamination of equipment and similar unwanted but necessary operations.

In other chemical plants it is the safety engineer who is called when suspicious materials are found in laboratories, when cylinders are found leaking, and when unknown gases make their presence unmistakable throughout the buildings. The disposal of unstable chemicals, defective cylinders, toxic gases and similar materials is often a direct responsibility of the Safety Department.

We should expect our chemical safety engineer to have a fair degree of familiarity with chemical processes in general and a detailed and quite comprehensive knowledge of the hazards involved.

His questions and suggestions at all phases in the development of new processes may save money, equipment and lives—and often result in improved methods as well.

LITTLE BONERS



Who Was Inebriated?

A little alcohol was needed to make that specialty product. Only a mite. But the government is so fussy about keeping tabs on alcohol.

So the big tank and the little tank, the fill valves and the drain valves, the pump motor switch, all were put under padlock. Joe, the operator, was given the keys and

told he'd darn sight better keep close control of that alcohol.

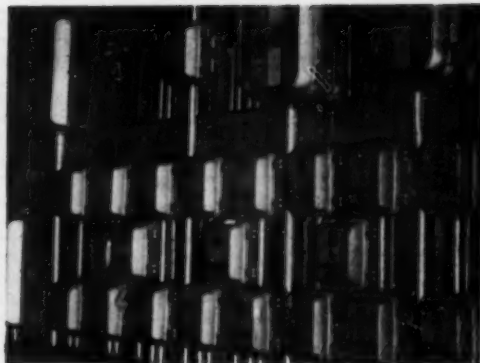
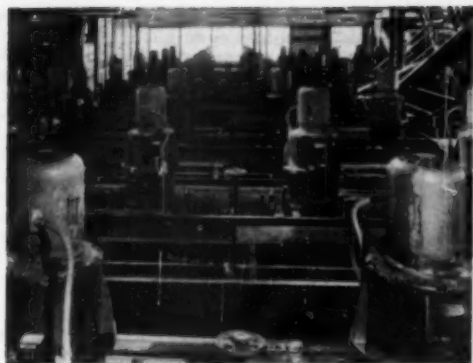
Then one day the raw materials engineer discovered a shortage of 7.138 gal. Worst of all, it was just when he had to turn in a report to Uncle Sam. The operators couldn't explain it. Finally the plant manager called in two other engineers. Their orders: "Find out where that alcohol went."

Evaporation losses were calculated down to the fourth decimal place. Pipelines, tanks and pumps were checked inch by inch. Once, twice, three times. Still nothing that showed what happened to that 7.138 gal. of alcohol.

On the second day of sleuthing one bright engineer noticed that the "shortage" was just about equal to the capacity of the pipe line, valves and pump.

The raw materials engineer had made a mistake in addition.

If you think that was an expensive little boner, you don't know how the Bureau of Internal Revenue works! Why not send in your true "little boner" story? Address: Editor, *Chemical Engineering*, 230 West 42nd St., New York 18, N. Y.



MOTORS & MOTOR CONTROL

CHEMICAL ENGINEERING REPORT—JULY 1951

Victor J. Kropf, Manager, Petroleum and Chemical Section,
Industrial Department, Westinghouse Electric Corp., East Pittsburgh, Pa.

OVER 70 percent of the total electric power used in the chemical process industries is consumed by motor driven machinery.

In the past 10 years, the number of electric motors used by the various process industries has more than doubled—with possibly 2 million or more motors of all sizes and kinds in operation today in these industries. The

tremendous use being made of motorized equipment continually emphasizes the importance of electric motors and controls in successful chemical plant operation.

It is therefore essential that those charged with operating responsibility have a good idea of the various kinds of motors and controls available, and their principal applications. The plant

electrical engineer or the machinery manufacturer may recommend electrical equipment for specific drives. However, it is particularly desirable for the process engineer to have a clear picture of the application of electric motors and controls because their characteristics have a very definite effect on the proper functioning of the associated process equipment.

Factors in Selection

Certain fundamental considerations must be taken into account in selecting the correct motor and control for a given job. The application must be approached primarily from the standpoint of the driven machine. The actual requirements of each drive should be carefully analyzed, not only for immediate needs but also for possible future performance.

MACHINE CHARACTERISTICS

The first factor to consider is the size or horsepower rating of the motor required to handle the load. With standard drives, most machinery builders have established the exact brake horsepower demanded by their particular machine—so that a motor of

the nearest standard horsepower rating is recommended. Where no machine data is available, motor horsepower may be determined by test, based on loading the machine under actual or simulated operating conditions. If tests are not practical, the power requirements should be calculated accurately, using specific machine constants and known load factors.

On special drives or those of an intermittent nature, thought must be given to the duty cycle involved. This applies especially to peak loads or momentary overloads, and the number and frequency of starts, stops and/or reversals. The motor rating is then based not only on torque capabilities, but also on thermal capacity

sufficient to handle the average or root mean square loads taking into account plugging or braking and any jogging or inching operation.

Some process equipment such as reciprocating pumps, compressors, and conveyors must be started while fully loaded. Other drives such as centrifugal pumps, fans, and agitators have light load at starting. Many applications require considerably more torque to start and accelerate the load than to run it, and the reverse is also true.

Motor torque characteristics must match those of the drive. It is, therefore, necessary to consider both starting torque and maximum or breakdown torque in applying a motor. The inertia of the load also enters into the picture, since it determines the accelerating time. High-inertia loads result in long periods of acceleration,

Typical Applications	AC Motors										DC	
	Normal Torque Squirrel Cage	High Torque Squirrel Cage	High Slip Squirrel Cage	Wound Rotor	Synchronous	Low Torque Single Phase	Medium Torque Single Phase	High Torque Single Phase	Blunt Wound	Compound Wound	Series Wound	
Agitators— $\frac{1}{2}$ to 15 hp.												
Attrition & ball mills—20 to 900 hp.												
Banbury mixers—200 to 900 hp.												
Beaters—up to 200 hp.												
Blowers—up to 500 hp.												
Bucket elevators—5 to 25 hp.												
Chippers—up to 1,500 hp.												
Compressors—up to 600 hp.												
Conveyors—3 to 100 hp.												
Cranes & hoists—3 to 150 hp.												
Crushers—5 to 300 hp.												
Extractors—3 to 100 hp.												
Fans—up to 150 hp.												
Grinders (pulp)—1,000 to 4,000 hp.												
Grinders and granulators— $\frac{1}{2}$ to 30 hp.												
Hammer mills—20 to 200 hp.												
Jardans—up to 400 hp.												
Kilns—20 to 100 hp.												
Mixers—2 to 200 hp.												
Pulverizers—10 to 250 hp.												
Pumps (centrifugal)—up to 1,000 hp.												
Pumps (reciprocating)—up to 200 hp.												
Shredders—5 to 300 hp.												
Stokers—5 to 50 hp.												

Starter Types	
Squirrel cage	Magnetic full or reduced voltage.
Wound rotor	Manual, semi-magnetic or full magnetic with secondary resistance.
Synchronous	Magnetic full or reduced voltage.
Single phase	Manual or magnetic full voltage.
Direct current	Manual or magnetic with field and armature resistance.

requiring motors of large thermal capacity with additional copper and iron over and above that needed to provide high starting torque alone.

The operating speed characteristics of the process equipment dictate the type of motor and control to be applied in many cases. Most drives operate at a speed lower than that of the motor thus requiring some form of speed reduction. If the gearing is built into the machine, the motor can be direct-connected to the drive. In other cases, a gearmotor or coupled motor and speed reducer might be used.

Variable or adjustable-speed performance must be definitely established as to speed range, degree of speed adjustment, and load requirements at all speeds. Constant torque or constant horsepower drives both require variable-speed or multi-speed motors, as the case may be, with suitable control equipment.

AMBIENT OPERATING CONDITIONS

Motor and control selection is strongly influenced by the ambient conditions under which they will be operating. If the location is indoors, the temperature and availability of clean ventilating air must be investigated. For outdoor operation, con-

sideration should be given to prevailing weather, rain, snow, sand or dust storms, and especially extremely high or low temperatures such as above 40 deg. C. or below 10 deg. C. In explosive atmospheres, the liquid, vapor, gas, or dust involved must be clearly established so as to specify suitable electrical equipment.

Special pumps and agitators are called on to operate while fully covered with water or other liquids. Care must be exercised to select motors with adequate protection for submerged operation.

Hazards such as corrosive fumes, acid spray, excessive moisture, oil vapor, salt air, abrasive dust, steam and fungus growth must be given serious attention to make sure motors and control are selected with proper protection or are located away from the contaminated area. Provision must be made to take care of any abnormal vibration, shock, or tilting that may be transmitted from the driven machine to the motor or control through shafts, couplings, and mountings.

The altitude of a proposed location should not be overlooked. Motors are rated for satisfactory operation at rated load without exceeding the nameplate temperature rise, and with an ambient temperature not exceed-

ing 40 deg. C. at any elevation from sea level up to 3,300 ft. Above 3,300 ft., the motor temperature rise will increase 1 percent of the nameplate rise for each 330 ft. above 3,300 ft.

Control apparatus is designed for satisfactory operation at rated load with an ambient temperature of 40 deg. C. at any elevation from sea level up to 6,000 ft. For operation above 6,000 ft., continuous duty resistors, auto transformers, and control circuit transformers must be derated to 75 percent of their normal kva. rating.

POWER SUPPLY

The characteristics of the power supply definitely fix certain characteristics of the resistor and control to be selected. A few plants may be located in areas where only direct current is available from the local power supply. The combined demand for large amounts of low voltage direct current power and low pressure steam for process work may be large enough in other plants to dictate the installation of bleeder turbines driving direct current generating equipment.

In such cases, 115 or 230 v. direct current motors may well be chosen for all drives throughout the plant particularly if materials handling equipment such as cranes, hoists, and car dumpers is being operated or if a number of machines require speed adjustment. If a great many constant speed motors and/or large horsepower ratings are involved, economic considerations may justify bringing in a new alternating current power supply, or installing alternating current generating equipment to permit the use of squirrel cage or synchronous driving motors.

Most plants have three-phase 60-cycle alternating current power available at several voltages for supplying motor loads. In some localities, 25-cycle and 50-cycle three-phase power supplies are also common. Standard voltages for motor operation: Low voltages—110, 208, 220, 440 and 550 v; high voltages—2,300, 4,000, 4,600, 6,600 and 13,200 v.

It is, of course, not practical to build motors of all horsepower ratings for operation on all of these standard voltages. Fractional horsepower, single phase, and universal motors are generally designed for 110 or 220 v. maximum. Polyphase motors up to 25 hp. are usually wound for 220 or 440 v. with a maximum of 550 v. Motors as large as 1,000 hp. may be operated at 440 or 550 v. and motors as small as 25 or 30 hp. have been applied on 2,300 v. systems. In some plants 2,300 v. motors are limited to machines requiring at least 100 hp. or

more. Voltages higher than 4,000 are not generally applied to motors under 250 hp. Based on the experience of several chemical plants, it is desirable to operate motors rated over 1,000 hp. directly from a 13,800 v. source.

Table I gives a general idea of standard power system voltages and what size motors may be used.

Alternating current motors are designed to operate successfully at rated load with a variation in voltage of plus or minus 10 percent of rated voltage or a variation in frequency of plus or minus 5 percent of rated frequency. Satisfactory performance will not be impaired with a combined variation in both voltage and frequency of 10 percent above or below rated values provided the frequency variation does not exceed 5 percent. However, alternating current motors are not guaranteed to give successful operation under conditions of simultaneous voltage and frequency variations in opposite directions.

Any deviation from rated frequency and voltage will result in changes in power factor, torque, speed, and efficiency. For a motor to give very nearly normal operating characteristics, changes from normal voltage should be accompanied by corresponding changes in frequency and vice versa.

SYSTEM CAPACITY

The choice of motor control to be used depends largely on the voltage and capacity of the power system. Industrial control equipment is applicable for voltages up to 5,000 and motor ratings as high as 3,000 hp. with certain types of starters. Metal clad switchgear equipment with air or oil circuit breakers should be selected for (1) starting and controlling motors for operation above 5,000 v. or (2) where the motor rating exceeds the capacity of industrial control contactors and circuit breakers. For low voltage circuits a separate starter either with or without a combination air circuit breaker for short circuit protection might be specified for each motor. Where a number of motors are operating near a central location, the choice might be a group control or control center with air circuit breakers and contactors for each motor mounted in separate compartments of a common metal enclosed structure.

The allowable starting current inrush and the maximum short circuit currents must be established for each application at the various plant locations. The locked rotor current of the motor should be within the limits set by the power supply if full-voltage across-the-line starting type of control

equipment is desired. Where line-starting the motor would cause excessive dips in line voltage or other disturbances on the power system, reduced voltage control equipment such as auto transformer, resistance, or reactor type starters would be selected.

The maximum short circuit power that the system can deliver to a fault at the motor location will determine the interrupting capacity required of the motor starter. In general, motor starters have a standard interrupting capacity of ten times the current rating of the contactor. Most high voltage power sources of 2,300 or 4,600 v. can produce fault currents far in excess of this. Requirements of 25,000 kva. or 50,000 kva. at these voltages are usually met in chemical process plants with oil immersed high voltage starters which in many cases afford sufficient protection for the feeder circuit without the necessity of installing a feeder circuit breaker.

For fault protection on systems capable of producing up to 150,000 kva. at 2,300 v. or 250,000 kva. at 4,600 v., the control specifications usually call for a combination starter with high interrupting capacity, current-limiting, disconnecting type power fuses. Where a power source may be capable of producing anywhere from 50,000 kva. to as much as 1,000,000 kva. or more, motor starters would be selected on the basis of metal clad switchgear with circuit breakers of the required current rupturing ability. In some cases it may be advantageous to install reactors to limit the fault current permitting control equipment with circuit breakers and contactors of lower interrupting capacity to be applied.

POWER FACTOR

Most public utilities have a clause in their power contracts requiring a plant with low power factor loads to pay a penalty charge or an increased rate. As every plant engineer knows, the power factor of a motor represents the percentage of the load or power current to the total line current. The line current is made up of magnetizing or reactive current and

power or active current. This reactive current represents just as real a burden to the power system as the active or load current even though it does not represent any actual work accomplished at the driven machine.

The limiting factor of both generators and transmission lines as well as plant distribution systems is current or ampere carrying capacity. The power system must be capable of supplying whatever ampere load is demanded of it even though only half the current furnished a given plant may be going into useful work. In such a case the power factor of the load would be 50 percent and the public utility or the plant generating system would be delivering twice as much current or kva. as actually required by the plant load in horsepower or kilowatt output.

The power company, therefore, not only charges process plants for the kilowatt hours used but also imposes a severe penalty on any plant with excessive reactive loads. Where a plant has its own generating system, double capacity generators would be required to meet a 50 percent power factor load condition and the entire distribution system would have to be correspondingly larger. As a result more and more attention is being given to raising plant power factor in an effort to keep power costs and equipment investment to a minimum.

An induction motor has an inherent lagging power factor in that the magnetizing current lags behind the voltage because of the inductance of the windings. The magnetizing current of a synchronous motor on the other hand can be made to lead the voltage by sufficient increase in field excitation. Many plants, therefore, use over excited synchronous motors with 80 percent leading power factor for constant speed drives to compensate for the lagging power factor of other machines.

Current through a capacitor leads the voltage, representing a completely reactive load. Thus capacitors of sufficient ratings may be selected to provide all of the necessary leading current to fully balance induction motor

Table I—Desirable Motor Voltage Ratings

Nominal System Voltage	Integral Horsepower Motors		Fractional Horsepower Motors		Motor Horsepower
	Poly-phase	D. C. or 1 phase	Poly-phase	D. C. or 1 phase	
120.....	110	115	110	115	Up to 5
120/208 Y.....	110/230	115	110/230	115	Up to 7½
240.....	230	230	230	230	1/2 to 200
480.....	440	...	440	...	1/2 to 1,000
600.....	550	...	550	...	1/2 to 1,000
2,400.....	2,300	...	...	...	50 and larger
4,160.....	4,000	...	...	...	150 and larger
4,800.....	4,600	...	...	...	250 and larger
6,900.....	6,600	...	...	...	500 and larger
12,900.....	12,300	...	...	...	1,000 and larger

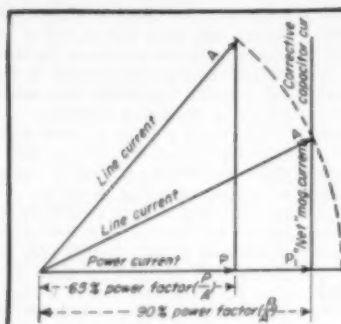


Fig. 1—Vector diagram of power factor correction

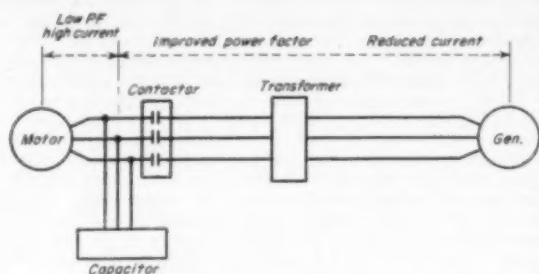


Fig. 2—Motor generator hookup for power factor correction

SELECTION is influenced by power factor considerations. With induction motors, capacitors are used to correct power factor.

loads bringing the power factor up to as high as 100 percent or unity. The corrective effect of capacitors is shown by the vector diagrams in Fig. 1 and the schematic diagram in Fig. 2.

Power companies usually permit some lagging current without penalty so that the power factor need only be brought up to the minimum allowable value or a little above it to obtain the most favorable power rates. Consideration must also be given to plant wiring capacity and transformer ratings in determining exactly how far to go in correcting plant power factor to gain the maximum benefits.

DEMAND CHARGES

Electrical energy cannot be stored up in advance to meet anticipated loads. Boilers, turbines, and generators must all be installed to supply the maximum peak load required of them so that they will be ready at a moment's notice to deliver all the power a given plant may need at any time for its operations.

If the momentary or short time peak demand is considerably higher than the average or normal load, the generating equipment is running at less than full load most of the time, resulting in poor operating efficiency and high equipment investment. To compensate for this, power companies usually include a so-called demand charge in their rate structure based on the maximum load carried during a given period of time. A plant may have to pay a tremendous penalty for unusually heavy power requirements for a short time—possibly only an hour or so. The power cost is sometimes computed on maximum demand alone. Thus a peak load for only one day, regardless of how light the normal load may be, can result in electrical charges of the same amount as

though the plant had actually used the peak power every day for the entire billing period.

In most process plants, motor driven machinery represents a continuous power load rather than an intermittent one. There are many applications, however, requiring various motor operations from time to time as the occasion demands. The plant operator or process engineer may save his company a good many dollars in demand charges by scheduling additional motor loads at off peak periods and by operating the plant for a majority of the time or for as much time as is practical at or near the maximum peak power required.

Certain features of both motors and control can be specified to keep demand charges down. Motors with

low locked rotor currents may be installed for starting high torque loads across the line. Wound rotor motors with secondary resistance controllers can be used to start heavy loads with a minimum of starting current. Reduced voltage control such as auto transformer, reactor, or resistance starters will cut down the initial current inrush of squirrel cage motors on other applications. Controls for a number of motors may be interlocked to prevent simultaneous starting after a power outage or other shutdown.

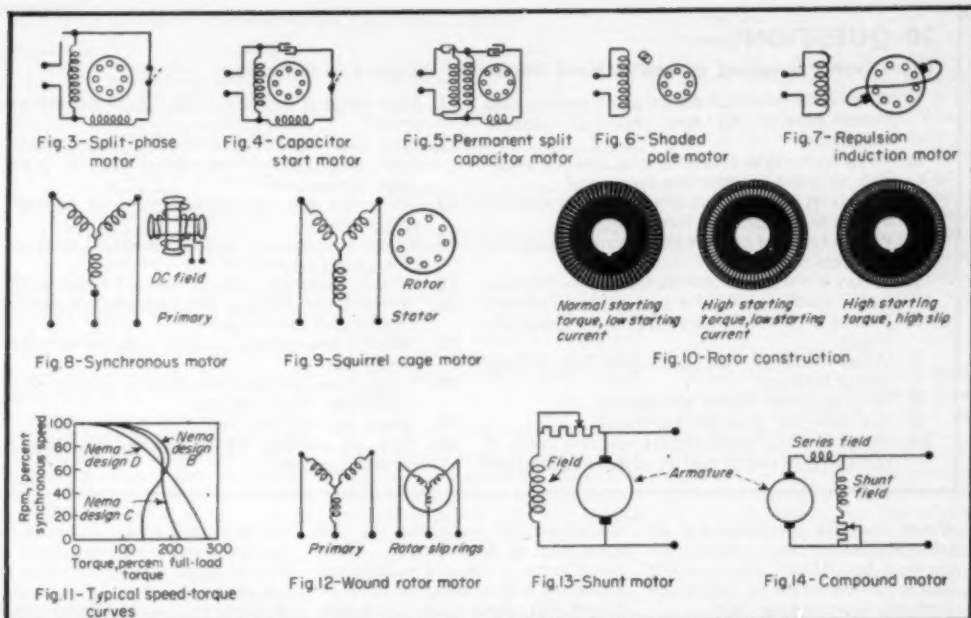
A careful review of motor operation by the process engineer in his own individual plant will suggest other ways of maintaining a high load factor and will be materially helpful in meeting the problems of power rates and demand charges.

Relative Cost

Performance characteristics usually determine the particular type of motor to be selected for a given drive. There are applications, however, where several designs of motors have suitable characteristics and the decision may be strongly influenced by the relative cost of the particular motors involved and their associated control. It is impossible to establish a fixed relationship between costs of various types of motors and control for all ratings

since the relative costs vary widely with horsepower, voltage, and type of enclosure. However, the table below shows an approximate cost comparison between the various types of motors and control commonly used in the process industries. It is based on 440-v., 3-phase, 60-cycle open motors having an average rating of 100 hp. at 1,200 rpm. with full voltage magnetic control in general purpose type of enclosures.

Motor Design	Approximate Relative Cost		
	Motor Only	Control Only	Motor and Control
Normal torque squirrel cage	100%	100%	100%
High torque squirrel cage	115	100	115
High slip (5-8%) squirrel cage	124	100	120
High slip (8-12%) squirrel cage	155	100	150
Wound rotor induction	130	685	190
Synchronous (100% PF.)	150	800	205
Synchronous (80% PF.)	155	800	225
Shunt wound d.c.	175	540	220
Series or compounded d.c.	180	540	225



MOTORS FOR CONSTANT SPEED DRIVES are a.c. synchronous or induction and d.c. shunt or compound wound.

Motors for Constant Speed Drives

Motors and control may be classified in many ways. One logical method is on the basis of the speed and operating requirements of the driven machine. Motors are thus divided into two main groups: (1) constant or single speed motors, and (2) variable, adjustable or multi-speed motors.

For constant speed drives, alternating current single phase or polyphase synchronous or induction motors may be selected as well as direct current shunt or compound wound motors.

SINGLE PHASE MOTORS

Several types of single phase induction motors are available for process plant applications including split-phase, capacitor, shaded pole and repulsion motors. Because single phase induction motors cannot produce a rotating magnetic field as can polyphase motors, they are not inherently self starting. It is, therefore, necessary to develop torque during the starting period either through an artificial rotating field or by means of a commutator. After the motor has reached operating speed, centrifugally operated devices disconnect the starting windings or short circuit the com-

mutator since they are not needed.

A split-phase motor (Fig. 3) is a single phase induction motor equipped with an auxiliary starting winding displaced 90 deg. in magnetic position from the main or running winding with which it is connected in parallel during starting. A centrifugally operated switch removes the auxiliary winding from service when full speed is reached. This type of motor is limited to fractional horsepower sizes and on applications with infrequent starting and low inertia loads, such as sump pumps, fans, blowers, etc.

Capacitor motors (Fig. 4) are provided with a main winding for direct connection to the power source with an auxiliary winding connected in series with a capacitor. When the capacitor is only in the circuit during starting, the motor is known as a capacitor-start motor and a centrifugal switch or relay opens the auxiliary winding as the motor approaches full speed. A permanent-split capacitor motor (Fig. 5) has the same value of capacitance for both starting and running conditions, whereas a two-value capacitor motor uses different values of effective capacitance for starting and running. The two-value capacitor

or capacitor run motor, as it is often called, has good starting characteristics as well as improved operating performance and is selected for wide application from fractional horsepower sizes up to 5 or 7½ hp. Permanent-split capacitor motors are usually limited to fractional horsepower drives. Capacitor start motors find extensive use on heavy duty drives.

A shaded pole motor (Fig. 6) is a single phase induction motor provided with an auxiliary short circuited winding or windings displaced in magnetic position from the main winding. Motors of this design have very low starting and breakdown torque and are used for fan duty in the sub fractional horsepower range.

Repulsion-start, induction-run motors (Fig. 7) have a stator winding arranged for connection to a source of power and a rotor winding connected to a commutator. Short circuited brushes on the commutator are placed so that the magnetic axis of the rotor winding is inclined to the magnetic axis of the stator winding. At a predetermined speed the rotor winding is short-circuited or otherwise connected to give the equivalent of a squirrel cage winding. Although they are inherently expensive motors from a manufacturing standpoint, repulsion-start induction-run motors are capable of good performance under

20 QUESTIONS—

These twenty questions as well as many others are answered in this report:

1. What factors affect selection of motors and motor control for the chemical process industries?
2. What motor and control enclosures are available to meet process requirements?
3. Which types of motors are commonly used to drive various process machines?
4. Which types of control are commonly applied for each motor?
5. When is a wound rotor motor or synchronous motor used instead of a squirrel cage motor?
6. Where is direct current equipment generally used?
7. What voltages are desirable for various motor ratings?
8. Why is power factor important?
9. Are demand charges justified?
10. What are the approximate relative costs of each type of motor and its associated control?
11. How large a motor can be made explosion proof?
12. How much does explosion proof equipment cost compared with standard general purpose equipment?
13. What are the normal functions of control equipment?
14. When is magnetic control specified instead of manual control?
15. Why is reduced voltage control necessary?
16. Where is the dividing line between industrial control and switch-gear?
17. What is low voltage release and low voltage protection?
18. When is an autostarter selected instead of a resistance type starter?
19. What is a synchro-tie?
20. How do various forms of variable speed drives compare?

adverse operation conditions and are being applied on single phase drives up to 5 hp. These motors provide high break-away torque for high inertia loads and heavy starting duty.

SYNCHRONOUS MOTORS

Polyphase synchronous motors (Fig. 8) consist of an armature winding on the stator for direct connection to the alternating current power source and a rotating field winding energized from a direct current source through collectors or slip rings on the rotor shaft. Certain smaller ratings are designed with stationary field windings and rotating armature windings. Field excitation power may be obtained from a direct current plant distribution system but is more often supplied by a direct connected d.c. exciter or a separate a.c. to d.c. motor generator set.

The speed of a synchronous motor is independent of the load, being determined only by the frequency of the power supply and the number of field poles on the rotor. Starting is accomplished by first connecting the stator to the primary power source and short circuiting the field windings. Amortisseur starting windings incorporated in each pole face combined with the short circuited field windings give the effect of a squirrel cage rotor resulting in acceleration as an induction motor. At approximately 95 to 98 percent of synchronous speed, the direct current field excitation is applied and the short circuit on the field windup is opened, permitting the motor to pull into step and operate at absolutely constant speed.

The power factor of a synchronous

motor can be controlled by the strength of its field excitation. Unity power factor is obtained with normal excitation; leading power factor is obtained with above normal excitation. Where appreciable power factor correction is desired, a motor rated 80 percent leading power factor would probably be selected. Such a unit represents increased investment over a 100 percent power factor motor but the additional cost can usually be justified by the savings gained from power factor correction. This is particularly true in process plants with lightly loaded induction motors, or other low power factor loads. Synchronous motors not only improve power factor but they inherently act as voltage regulators by keeping line currents at a minimum on low voltage and at a maximum on high voltage.

Because of their constant speed and adjustable power factor features, synchronous motors are used extensively in the chemical process industries for driving large compressors, fans, blowers, pumps, crushers, grinders, ball mills, motor-generator sets and other continuously operated process machinery. Synchronous motors are used exclusively for those processes where a number of units must be kept in exact step with other units as in synthetic fiber production, pulp and paper operation, etc.

In plants employing large numbers of induction motors, arc or induction furnaces, welders, or other low power factor loads, synchronous motors with leading power factor provide economical improvement of over-all plant power factor and would be selected for all large low-speed direct-connected

constant speed drives. To insure that the corrective leading power factor will be most effective, the synchronous motors should be applied to continuously operating machines wherever possible and should also be physically located near the source of low power factor to afford maximum benefit to the plant distribution system.

Unity power factor synchronous motors under full load conditions operate at higher efficiency and are lower in first cost than 80 percent leading power factor motors. At less than rated horsepower with full load excitation, unity power factor machines draw leading current and hence supply power factor improvement when the driven machine is not fully loaded.

In spite of requiring higher starting currents, somewhat complex starting methods, and the necessity for direct current power for field excitation, synchronous motors usually represent the most practical and economical method of keeping power factor high and power costs low.

INDUCTION MOTORS

A polyphase induction motor is an alternating current machine in which the primary or stator winding is connected to the power source and the secondary or rotor winding has no line connections whatever—but is energized solely by currents induced by the flow of current in the primary as in a transformer. The induction motor is inherently simple, rugged, and reliable. It is applied more broadly in the process industries than any other type of motor.

There are two types of induction motors: (1) squirrel cage and (2)

Table II—Classification of Polyphase Squirrel Cage Induction Motors

Nema Design	Characteristics	Application
A	Normal torque Normal starting current Less than 5% full load slip	General purpose—propeller fans, agitators, grinders, etc.
B	Normal torque Low starting current Less than 5% full load slip	Centrifugal pumps, ventilating fans, blowers, machine tools, etc.
C	High torque Low starting current Less than 5% full load slip	Compressors, refrigerating machines, plunger pumps, conveyors, etc.
D	High torque Low starting current More than 5% full load slip	High inertia loads, punch presses, grinders, crushers, etc., with flywheels.
F	Low torque Low starting current Less than 5% full load slip	Special purpose, constant load, light starting centrifugal fans, M.G. sets, etc.

wound rotor. They have identical primary windings and but differ only in their secondary circuits.

The squirrel cage induction motor (Fig. 9) constitutes the most common design and is so named because its rotor construction is made up of bars and end rings similar to the wheel of a squirrel-cage. The secondary winding consists of heavy rotor conductors or bars suitably disposed in slots in the rotor core and short circuited by rings at each end of the rotor.

The speed of a squirrel cage motor is dependent on the frequency of the power supply, the number of magnetic poles in the stator winding and to a slight extent on the load. In an induction motor, torque is the result of induced currents produced by the difference in speed, known as slip, between the rotor and the rotating magnetic field on the stator. Thus, a squirrel cage motor must operate at a speed slightly lower than synchronous speed which is the speed of the rotating magnetic field of the primary. As the load demands more torque, the rotor speed decreases and the slip increases until primary current and induced secondary current are sufficient to provide the required torque. The slip is very small (usually less than 5 percent) so that for all practical purposes, squirrel cage motors are constant speed machines.

Various designs of squirrel cage motors have been developed to meet the wide range of starting conditions, current limitations, and torque requirements encountered in the process industries. Torque characteristics are determined by rotor design with particular emphasis on depth, width and shape of rotor slots as well as spacing and resistance of the rotor bars or conductors. The cross-sectional views of typical rotor punchings (Fig. 10) illustrate common construction practice for normal torque, high torque and high slip squirrel cage induction motors.

The National Electrical Manufacturers Assn. has developed standard classifications for polyphase squirrel cage integral horsepower induction

motors to meet various starting torque requirements (Fig. 11). Table II defines the Nema standard designs and indicates the general type of process machine drive to which each is most applicable.

WOUND ROTOR INDUCTION MOTORS

The wound rotor induction motor (Fig. 12) has a secondary circuit consisting of a polyphase winding or coils terminating in slip rings or collectors for connection to external resistance or other short circuiting means. Its locked rotor torque and locked rotor current depend on the value of external resistance in the secondary circuit and can be varied over a wide range to provide very high starting torques with minimum starting current. With the slip rings short circuited after starting, the speed of a wound rotor motor is essentially constant regardless of load. Under these conditions, the operating characteristics are the same as those of a squirrel cage motor.

Where wide variations in load or other requirements of the driven machine make high slip characteristics desirable, the slip rings are not short circuited after starting but are connected to a permanent slip resistor. The resistor is a continuous duty portion of the starting resistance and remains in the secondary circuit at all times. Under these conditions, the speed of the wound rotor motor varies with load and full load speed will be appreciably less than no load speed depending on the amount of permanent slip resistance in the secondary circuit.

Limited power sources, with generators or transformers rated only

slightly more than the motor to be started, often dictate the selection of wound rotor motors with sufficient starting resistance in the secondary circuit to limit inrush currents to full load values or less if necessary. Wound rotor motors find their most extensive constant speed application on drives requiring unusually high starting torques or very low inrush currents not available with ordinary squirrel cage motors. They are particularly well suited for starting process machinery under full load such as heavily loaded conveyors, displacement pumps and long line shafts.

DIRECT CURRENT MOTORS

Shunt and compound wound direct current motors are applicable to drives operating at a single or more or less constant speed with a given load.

A shunt wound motor (Fig. 13) consists of a field or stator winding connected in parallel with an armature or rotor winding so that line voltage is applied to both windings. Excellent speed regulation is provided by shunt motors even under overload conditions and they are selected for applications requiring essentially the same speed with full load on the machine as with light load operation. Because of their constant-speed characteristic, shunt wound direct current motors are employed on line shaft drives, machine tools, packaging equipment and similar precision equipment.

Compound wound motors (Fig. 14) have two separate field windings. One, usually the predominating field, is connected in parallel with the armature circuit, and the other is connected in series with the armature circuit. The speed of a compound motor tends to decrease as the load increases so that the speed regulation is relatively poor, possibly 20 percent or more depending on the size of the series field. This type of motor is applied for heavy starting duty and widely fluctuating loads where the full load and no load speeds are not required to be the same. Elevators, centrifugal or reciprocating pumps, air compressors, heavy conveyors and similar machines are driven by compound motors when direct current motive power is needed.

Motors for Variable Speed Drives

Various degrees of speed control are required by machine drives in the chemical process industries. Direct current motors offer ease of control and a wide range of speed adjustment,

but quite often wound rotor alternating current motors or multi-speed squirrel cage motors are selected as an economical means of meeting most of the operating speed requirements.

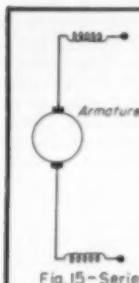


Fig. 15-Series motor

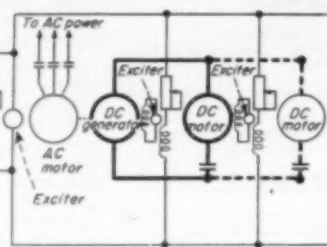


Fig. 16-All electric adjustable speed drive with exciters

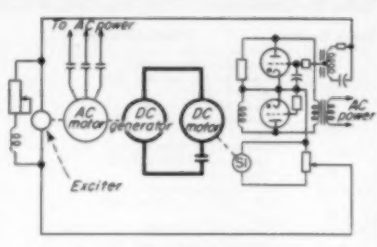


Fig. 17-All electric adjustable speed drive with electronic regulator

MOTORS FOR VARIABLE SPEED DRIVES include the series motor. Motor-generator sets are used for adjustable speed drives.

Constant speed motors in certain cases may be equipped with magnetic couplings or mechanical devices to provide variable speed operation.

Varying, adjustable and multi-speed motors are defined by NEMA. A varying speed motor is one whose speed varies directly with load, usually decreasing when the load increases. An adjustable speed motor is one whose speed can be varied gradually over a considerable range, remaining practically unaffected by load when once adjusted. A multi-speed motor is one which can be operated at any one of two or more speeds, each being practically independent of load.

To make the proper choice of electrical equipment for variable speed drives, it is necessary to establish the range of operating speeds, the load at each speed, and the desired speed regulation over the range. Unusually wide-speed ranges and very close speed regulation will require the most expensive adjustable voltage equipment. As the speed range narrows and speed is permitted to vary with load changes, several types of drive are available to the process engineer. Selection must be made on the basis of economy of operation, ease of adjustment, cost of maintenance, etc.

MULTI-SPEED SQUIRREL CAGE MOTORS

Where process machinery has several definite operating speeds, the simplest and most economical drive is a multi-speed squirrel cage motor. As many as four speeds are available with this type of motor through double stator windings and reconnection of coils. Speed ranges of 2 to 1 or 3 to 1 with one or two intermediate speeds are common, e.g. 1,800-1,200-900 rpm. or 1,800-1,200-900-600 rpm. Torques and other characteristics are similar to those described for the single speed squirrel cage motor so that speed regulation is good depending on the slip of the motor. Multi-speed synchronous motors are also applied

where absolutely constant speed must be maintained at each speed or where power factor correction must be provided.

WOUND ROTOR MOTORS

Wound rotor motors are ideally suited for variable speed drives requiring operation at any speed over a 2 to 1 or possibly 3 to 1 speed range. Speed regulation is poor, and at light loads speed control by secondary resistance is not always effective. With full load on the machine, however, speed adjustment down to half speed or lower is accomplished by inserting continuous duty resistors in the secondary circuit. In spite of low efficiency due to power losses in the external resistors, the wound rotor motor represents an inexpensive drive for a variable speed drive with an alternating current motor.

MECHANICAL ADJUSTABLE SPEED DRIVE

Mechanical devices have been developed having variable diameter sheaves or adjustable pulleys which can be combined with a constant speed motor to provide infinite speed control over a 6 to 1 range up to 40 or 50 hp. Wider ranges of speed can be obtained below 10 hp. with a maximum of possibly 16 to 1. Speed regulators may be applied to maintain constant speed at any load over the entire range although such refinements add to the initial cost of the equipment. In general, the combination of a constant speed squirrel cage motor with a mechanical variable speed unit results in a very economical drive depending, of course, on the exact horsepower rating, speed range, and class of service involved.

MAGNETIC COUPLINGS

Another combination consists of a constant speed squirrel cage or synchronous motor driving its load through a magnetic coupling or eddy

current clutch. The output speed is infinitely adjustable by varying the excitation to the coupling or clutch. With proper excitation control better than 1 percent speed regulation can be maintained over the complete range of speeds down to less than 5 percent of full speed. Adequate cooling by water or air must be provided for the coupling since all of the losses due to reduction of speed are dissipated in the form of heat in the coupling. Drives of this nature have been applied in a broad range of sizes from fractional horsepower units to large fan drives rated several thousand horsepower. They are more costly than mechanical speed changers but afford wider range of horsepower and speed as well as closer regulation.

SHUNT AND COMPOUND MOTORS

Direct current motors of the shunt or compound wound type operating from a fixed voltage source are subject to easy speed adjustment by shunt field control over a normal range of around 4 to 1. In special cases, speed ranges of 8 to 1 have been accomplished by field control—but usually any speed reduction below 25 percent of full speed is obtained by series armature resistance. Shunt motors maintain constant speed at any speed setting in the range of field control, although with resistance in the armature circuit the speed varies with the load. The shunt wound direct current motor is unequaled for flexibility of speed control and its broad versatility more than offsets its higher cost. Wherever direct current power is already available, this type of motor would be indicated for all adjustable speed drives.

SERIES MOTORS

Series wound direct current motors (Fig. 15) are definitely varying speed motors since their speed decreases appreciably with even load increase. As the name implies, the field windings

are connected in series with the armature so that the field is energized in direct proportion to the load current. The speed of a series motor can be controlled by series resistance but no accurate speed setting is possible because of the inherently poor regulation. Full load speed may be as low as 20 percent of light load speed, and if a series motor were completely unloaded its speed would become dangerously high—possibly to the point of self destruction. This characteristic is an advantage on applications such as loading towers, cranes, hoists, elevators and car dumpers since it results in slower, more careful handling of heavy loads and faster action on light loads. Plants whose processes require heavy material handling machinery usually have a direct current power system with a fixed voltage of 115 or 230 v. for supplying series motor loads of this type.

ALL-ELECTRIC ADJUSTABLE-SPEED DRIVES

Where no source of direct current power is available, consideration would be given to motor generator sets or rectifiers for constant voltage power to supply a large number of direct current motors. Certain wide speed range applications may justify the installation of an individual motor generator set to supply each driving motor independently. This would permit adjustment of voltage to each motor armature to obtain a very wide range of operating speeds. Such a system is designated as an adjustable voltage drive.

The conventional adjustable voltage drive (Fig. 16) consists essentially of a main direct current shunt wound driving motor together with an adjustable voltage direct current generator and a constant voltage exciter. These are both driven by a constant speed squirrel cage induction motor operating from the alternating current plant distribution system. Motor speed is controlled by varying the voltage of the generator through adjustment of the generator excitation. By variation of the motor field strength also, a total speed range can be obtained as high as 40 to 1. This system was originally developed and used for large drives rated in thousands of horsepower—but its flexibility, wide speed range, and ability to use alternating current power have extended its application to smaller motors. Adjustable voltage systems are now applied on drives as small as 1 or 2 hp. and even fractional horsepower.

To make the scheme economical for drives of small and medium horsepower, the control equipment has been

Table III—Comparison of Variable Speed Drives

Type of Drive	Hp. Limits	Speed Range	Inherent Regulation	Order of Cost
Multi-speed squirrel cage motor.....	1/2 hp. & larger	2 fixed speeds	Very good	1
Multi-speed squirrel cage motor.....	1/2 hp. & larger	4 fixed speeds	Very good	3
Wound rotor induction motor.....	1/2 hp. & larger	3 to 1	Poor	2
Mechanical plus squirrel cage.....	Up to 75 hp.	6 to 1	Very good	5
Magnetic plus squirrel cage.....	1/2 hp. & larger	10 to 1	Fair*	6
Constant voltage shunt motor.....	1/2 hp. & larger	4 to 1	Fair*	4
Conventional adjustable voltage.....	1/2 hp. & larger	30 to 1	Good*	7
Electronic adjustable voltage.....	Up to 75 hp.	50 to 1	Excellent	8
Wide range adjustable voltage.....	1/2 hp. & larger	120 to 1	Good†	9

* Regulators can be applied to provide excellent regulation.

† Regulator required for this wide range.

greatly simplified and other refinements incorporated—eliminating the need for an exciter on some applications. For speed ranges from 10 to 1 up to 20 to 1 with good speed regulation, this type of apparatus would represent the cheapest form of adjustable voltage drive. Such drives are generally specified to be of unit or "package" construction below 200 hp. with the motor-generator set combined as a single frame machine. For larger ratings, the equipment is usually tailor-made with individual components assembled in more or less conventional design.

Electronic rectifiers have replaced the motor-generator and exciter in other cases so that the driving motor is supplied with rectified d.c. directly from an a.c. source. This type of variable speed drive is more costly than the conventional motor generator set system. This is due not only to the

rectifying equipment but also to the larger driving motor required to handle additional losses from the pulsating direct current. It has the advantage of wider range of speeds up to 40 to 1; also eliminates motor-generator mounting problems such as space and vibration.

By the addition of other control and regulating equipment, the speed range of the adjustable voltage drive has been extended as high as 120 to 1, with speed regulation of less than 5 percent at any speed over the entire range. This drive is by far the most elaborate and expensive of the variable speed systems but its regulation, speed range, and ease of adjustment are unexcelled by any other type of variable or adjustable speed drive (Fig. 17).

Table III shows a general comparison of variable speed drives including typical horsepower ratings, speed range, regulation, and relative costs.

Control Equipment

Practically every available type of motor control is required to meet the tremendous variety of applications in the chemical process industries. The right control equipment must be selected to coordinate the machine characteristics with those of the driving motor and the power supply.

The principal function of motor starting equipment is to accelerate a motor from rest to normal speed. Certain other features may be incorporated in motor controllers such as reversing, speed control, and protection against short circuits, overloads and low voltage. In process work, motor controls are often arranged to react to pressure, temperature, liquid level, humidity, etc. so as to automatically start or stop the machine, change its speed, or give some indication to the process engineer of the operating conditions.

Full-voltage across-the-line starters are arranged to connect the motor windings directly to the source of power. Reduced voltage starters are arranged to connect either a resistor, an auto transformer, or a reactor in series with the motor windings and the power supply during starting and accelerating. As the motor approaches full speed, the resistance or inductance is cut out of the circuit and the motor windings are connected directly across the line for continuous running at full speed.

DIRECT-CURRENT CONTROLLERS

Due to the low armature resistance of direct current motors, d.c. controllers usually provide a number of steps of resistance in the armature circuit to protect the armature windings from excessive current and also minimize any disturbance to the voltage of

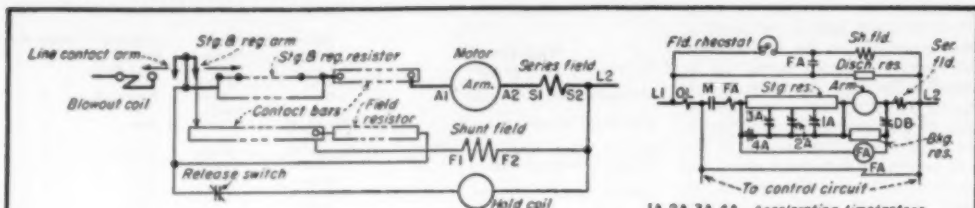


Fig. 18 Manual DC motor controller

Fig. 19 Magnetic DC motor controller

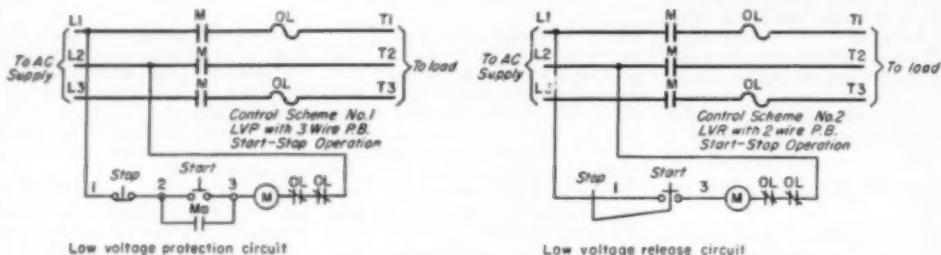


Fig. 20 Squirrel cage starters

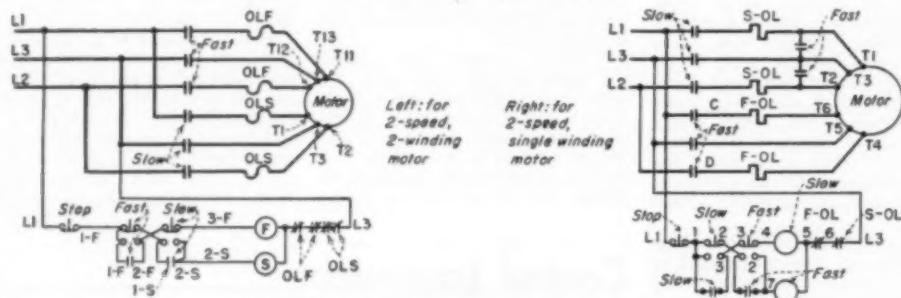


Fig. 21—Multi-speed squirrel cage motor starters

MOTOR CONTROL EQUIPMENT includes d.c. motor controllers and squirrel cage starters as shown in these schematic diagrams.

the power system. As the motor gradually comes up to speed, the resistance is cut out in steps until at full speed the armature is directly across the supply voltage. Very small motors around 2 hp. or less may be started on full voltage if no limitations are imposed by the power supply or the driven machine.

Speed control is very easily accomplished with a d.c. motor controller by designing a portion of the starting resistance for continuous duty and by inserting a variable resistor or rheostat in the field circuit (Fig. 18). Speeds below normal are obtained with full field strength by increasing the resistance in series with the armature. Speeds above normal are obtained with no resistance in the armature circuit

by increasing the resistance in the field circuit, which decreases the magnetic field strength.

Manual starters, consisting of a cabinet containing starting or speed adjusting resistors with an operating lever and face plate, may be selected as the most economical control for direct current motors rated 150 hp. and smaller. For pushbutton control of all ratings, magnetic starters would be chosen with adjustable time limit acceleration and resistors mounted either on the front of the panel or above it for accessibility. The field rheostat usually has a simple hand wheel to permit manual adjustment of speed—although in some cases it may be motor operated. Acceleration can be under the control of the oper-

ator with some magnetic controllers or can be made automatic under the control of time or current sensitive relays (Fig. 19).

Direct current motor control always should be provided with low voltage protection to disconnect the motor from the line in the event of power failure even if only momentary. This feature prevents the armature from having full voltage applied to it at standstill when power is restored and insures that all armature resistance is in the circuit before the motor can be started again. Some form of protection against loss of field power is also a desirable part of a direct current motor starter to prevent the motor from "running away" with no field excitation.

SQUIRREL CAGE STARTERS

Squirrel cage motors are all designed for full-voltage across-the-line starting. The majority of squirrel cage starters (Fig. 20) consist of a simple three pole switch or contactor arranged to connect the stator windings directly to the plant distribution system. Both manual and magnetic starters usually include protection against motor overload, also. Manual across-the-line switches are used for drives with small ratings of polyphase and single phase motors—around 7½ hp. and smaller. Magnetic starters offer the advantages of remote control, low voltage protection or release, and automatic operation for motors of all sizes.

Low voltage protection is used where restarting of machines after power failure should be under the guidance of an operator. This type of protection disconnects the motor from the line in such a way that the control will remain in the off position until the operator restarts the motor.

Low voltage release will disconnect the motor from the line in case of power failure but will also automatically reconnect it upon restoration of service. Therefore, low voltage release would be specified for starters on essential continuous duty or remotely

located drives such as ventilating fans and sump pumps.

It is often necessary or desirable to provide short circuit protection as well as a disconnecting device for each individual motor circuit. In such cases, a combination starter would be specified with a circuit breaker and contactors in a common enclosure to provide standard interrupting capacities up to 15,000 root mean square amp. For large size starters up to 25,000 root mean square amp. interrupting capacity can be obtained with 600 amp. frame air circuit breakers. Such combination motor starters provide adequate protection on low voltage circuits of 600 v. and below and result in a very economical control installation.

MULTI-SPEED STARTERS

Control for multi-speed squirrel cage motors (Fig. 21) must include provision for changing stator winding connections so as to increase or decrease the number of poles, thereby changing its synchronous speed. Manual drum switches are sometimes selected for motors up to 5 hp. or so. Magnetic starters for all sizes of motors are provided with multiple contactors mechanically and electrically

interlocked to prevent energizing both sets of windings at the same time. These starters are generally designed for full voltage starting and can also be specified for reversing service or in combination with a circuit breaker. Practically any sequence of high or low speed starting or running can be accomplished manually or automatically as required.

REDUCED VOLTAGE STARTERS

Limitations by the power company on allowable current inrush make it necessary to apply reduced voltage starters with one or more steps of starting resistance or inductance to keep the starting current within the prescribed limits. Reduced voltage starters may also be recommended to limit the initial torque imposed on the driven machine to prevent possible damage to the mechanism from the shock of sudden starts.

A resistance type reduced voltage starter (Fig. 22) is usually satisfactory where low first cost is more important than high starting torque. With resistance in series with the stator windings, the line current is reduced in direct proportion to the reduction in voltage, and the starting torque is reduced in proportion to the square of

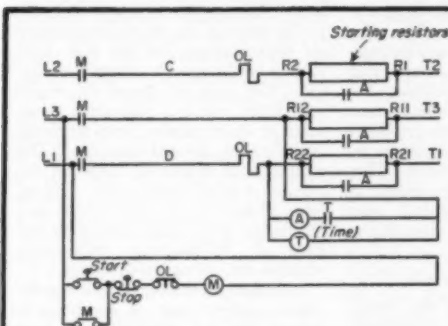


Fig. 22—Magnetic resistance type starter with 2-point acceleration

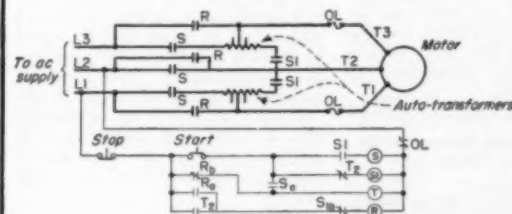


Fig. 24—Magnetic autotransformer reduced voltage starter with 2-point acceleration

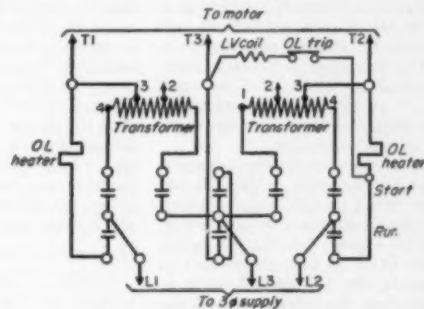


Fig. 23—Manual autostarter for reduced voltage starting of a squirrel cage motor

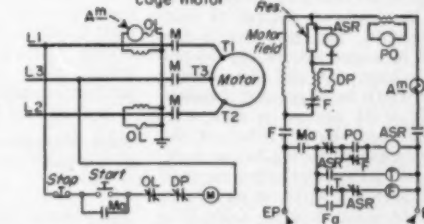
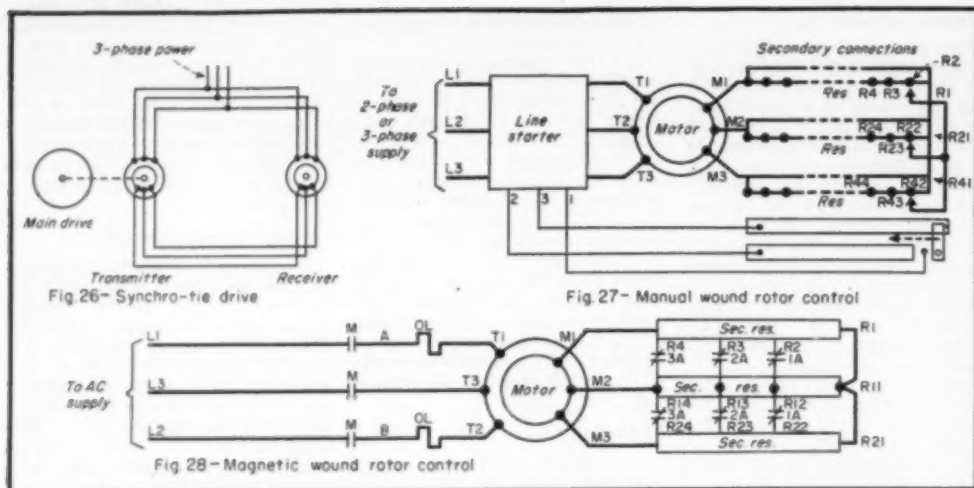


Fig. 25—Full magnetic, full voltage synchronous motor starter

MOTOR CONTROL EQUIPMENT includes reduced voltage starters (Figs. 22, 23, 24) and a synchronous motor starter (Fig. 25).



MOTOR CONTROL EQUIPMENT for keeping process machines in exact step (Fig. 26). Also wound rotor controls (Figs. 27, 28).

the voltage reduction. In other words, to reduce starting current to 64 percent of normal value, the voltage applied to the motor terminal would have to be reduced to 64 percent of rated voltage—and the starting torque under these conditions would be 41 percent of the full voltage value. This type of control is usually specified as a magnetic starter with pushbuttons and contactors for cutting out resistance in one or two steps as desired. They are applied on drives of 5 hp. and larger. A reactor in series with the motor during starting has the same effect on starting torque.

Auto transformer starters, compensators, or autostarters, as they are frequently called, provide higher starting torque than a resistance or reactor type starter for a given reduction in inrush current. With an auto transformer in the circuit, the line current varies as the square of the voltage ratio of the transformer. The starting torque also varies as the square of the voltage applied to the motor windings. Therefore, to obtain 64 percent of starting current, the auto transformer would be connected on the 80 percent voltage tap and the starting torque would be 64 percent of normal instead of 41 percent as with a resistance type starter. Thus, if the highest possible starting torque is desired with minimum starting currents, the additional cost of an autostarter would be justified. (See Table IV.)

Manual autostarters (Fig. 23) consist of a cabinet containing the auto transformer with necessary voltage taps, switching mechanism, and external operating handle. In the start

position, the motor windings are connected to the secondary of the auto transformer. After the motor accelerates, the operating lever is moved to the run position which removes the transformer from the circuit and connects the motor across the line. Where remote or automatic control is desired, magnetic starters (Fig. 24) would be selected with push-buttons and contactors to change connections between the motor and auto transformer. Where low cost is of prime consideration the choice would probably go to the manual type of autostarter. This type of reduced voltage control is available for starting squirrel cage motors on all general purpose drives of 5 hp. and larger.

SYNCHRONOUS MOTOR CONTROL

Insofar as connecting the stator winding to the line is concerned, starting a synchronous motor is identical to starting a squirrel cage motor. The same primary starting methods used for a squirrel cage motor are applied to synchronous motors, i.e. full-voltage across-the-line and reduced voltage either auto transformer, resistance, or reactor.

As contrasted to squirrel cage motor

Table IV—Relationship Between Inrush Current and Starting Torque

Type of Control	Voltage at Motor Terminals	Starting Current	Starting Torque
Across-the-line . . .	100%	100%	100%
Auto transformer . . .	80	64	41
Auto transformer . . .	64	41	17
Resistance	80	80	64
Resistance	64	64	41
Reactor	80	80	64
Reactor	64	64	41

control, however, synchronous motor starters must perform several additional functions. Excitation must be applied to the motor field at the proper time, the motor must be resynchronized if it pulls out of step, and provision must be made for power factor adjustment.

The majority of synchronous motors are started across the line with full-voltage full-magnetic starters (Fig. 25). This type of starter represents low initial cost and requires a minimum of maintenance. Semi-magnetic starters with manual control of the primary and automatic magnetic excitation control have limited application. Practically all synchronous motor starters today are selected on the basis of full-magnetic equipment, whether full or reduced voltage.

Industrial control type starters for either squirrel cage or synchronous motors are not applicable on high voltage circuits above 5,000 v. and with interrupting capacities above 50,000 kva. For such applications suitable metal clad switchgear equipment with air or oil circuit breakers would be selected. High interrupting capacity current-limiting fuses may be specified for industrial control to provide fault protection up to 150,000 kva. at 2,300 v. or 250,000 kva. at 4,600 v. using air or oil immersed contactors for control of the motor circuits.

SELF-SYNCHRONOUS OR SYNCHRO-TIE DRIVES

It is often desired to keep two or more process machines in exact step so that one unit follows the others at

the same operating speed as the first machine whatever its speed may be. For such applications, the secondary windings of two identical wound rotor motors are connected together either with or without secondary resistance in the circuit and the primaries are both energized from the same power source (Fig. 26). The motors will not rotate when thus connected but act as two transformers with primaries and secondaries in parallel. The two rotors must maintain the same phase relationship with their respective primaries. Therefore they will stay in exact step with each other and if one rotor is rotated in any way, the other rotor follows by the exact rotation of the first whether it be continuous rotation or only a fraction of a turn. Such self-synchronous combinations are commonly known as a synchro-tie or selsyn drive and are widely used to provide remote indication of liquid levels, valve positions and similar operations. They are often incorporated into control cabinets and panels and equipped with dials and pointers so as to afford the operator visual indication of process conditions.

In general, where power is transmitted by any combination of shafts, gears, or other mechanical units the same results can be accomplished by a properly designed synchro-tie drive. The more complicated the mechanical drive, the more pronounced will be the advantages of the electrical system. The few copper wires that replace heavy lineshafts and complicated mechanical parts can turn corners, traverse any angle, or travel hundreds of feet. The machines they connect all maintain an exact synchronous relation at zero speed and at all running speeds up to their rated maximum speed.

WOUND ROTOR MOTOR CONTROL

The first function of a wound rotor motor controller is to connect the motor stator winding to the line as with a squirrel cage or synchronous motor. The starting current depends on the amount of resistance in the secondary circuit so that the primary is always connected directly across the line at full voltage. The second function is to provide steps of secondary resistance that may be cut out gradually to bring the motor up to speed and to short circuit the slip rings under normal full speed operation. Speed control is obtained by introducing continuously rated portions of the starting resistance into the secondary circuit.

The simplest and cheapest method of controlling a wound rotor motor is fully manual. It involves a drum controller and a set of secondary re-

sistors. The drum controller has primary contacts for connecting the stator to the line and also has a number of secondary contacts for controlling the value of secondary resistance. When overload and low voltage protection are desired, a semi-magnetic controller (Fig. 27) would be specified consisting of a magnetic primary contactor similar to a squirrel cage starter and a manual face plate rheostat or drum controller with separate resistors for the secondary. A combination starter is often used with this type of control using the circuit breaker for main line disconnect and short circuit protection.

Full magnetic control for wound rotor motors (Fig. 28) consists of a panel with primary and secondary contactors controlled either by pushbutton or master switch. The start pushbutton closes the primary contactor at the same time energizes accelerating relays. These relays close the secondary contactors in sequence so as to cut out sections of the secondary resistance bringing the motor up to full speed. This type of control is the most

elaborate and expensive of the available slip ring motor control, but is applicable to motors of all sizes and affords the maximum degree of motor protection, automatic operation, and remote control which are essential in process operations.

SPECIAL CONTROL

Many drives in the chemical process industries require control equipment much more elaborate and complex than a standard off-the-shelf motor starter. Special tailor-made control must be selected for paper machine drives, rubber and plastic calendaring operations, glass making machinery, and various other drives involving automatic sequence of operation. Electronic apparatus and special regulating equipment is necessary where the process requires very close speed adjustment and regulation over wide ranges of both load and speed. In all these applications, motor and control characteristics must be coordinated as a complete system to insure that the over-all application is made in the best possible manner.

Mechanical Features

Certain mechanical features must be specified for motors and control used in the chemical process industries to insure that the right equipment is selected for each application. It is very important that enclosures, ventilation, mounting, bearings, etc. be coordinated properly to meet the operating conditions. In many cases, motors will require more attention than control equipment since it is often possible to install motor starters at remote locations protected from any hazards immediately associated with the drive. Where it is not possible to do this, control equipment must be selected with the same degree of protection as the motor.

In the manufacture of chemicals, acids, alkalis, and other corrosive materials, motors and control should be provided with adequate enclosures and should receive special treatment to protect the equipment from corrosive fumes, gases, or liquids. Where it is practical to do so, all motor frames and control boxes should be bonderized. Motor windings should receive extra dips and bakes in high quality insulating varnish. Consideration should be given to immersing contactors, circuit breakers, and other control parts in insulating oil for complete protection against both corrosive and explosive hazards.

The maximum protection is afforded by totally-enclosed fan-cooled

motors and control equipment which is enclosed in a properly-treated, non-ventilated, acid and fume-resistant enclosure with all apparatus immersed in oil. Explosion-proof motors and control would be specified where flammable vapors or dusts are also present as in petroleum refineries and synthetic rubber plants. Explosion proof equipment is designed and constructed to withstand an explosion within the enclosure without igniting the explosive gases, vapors and dusts which may be in the atmosphere surrounding the equipment.

EXPLOSION-PROOF EQUIPMENT

There is a practical limit to the size motor that can be built to meet explosion proof requirements. Motors have been built with Underwriters' labels as large as 1,250 hp. at 3,600 rpm. or about 900 hp. at 1,800 rpm. Ratings larger than this may be selected on the basis of forced ventilation with clean safe air. Motors with these larger ratings are sometimes separated from the hazardous atmosphere of the machinery room by means of a fire wall. Totally enclosed motors may be filled with an inert gas such as nitrogen under a pressure slightly above atmospheric to prevent any hazardous atmospheres from entering the motor frame. With an inert gas filled motor, heat losses are dissipated using water to cool the nitrogen or other

gas through a heat exchanger built into the motor housing. Motors of this construction rated over 2,000 hp. are in operation in chemical plants and offer a much more economical and practical machine than would be possible with explosion proof design.

Explosion proof starters with all apparatus immersed in oil are housed in steel tanks with sealed conduit connections of approved designs. Air break explosion proof control is enclosed in cast iron boxes with wide flanges and many bolts to provide the required flame paths and sealed joints. This type of construction is from two to three times as expensive as standard general purpose sheet metal-enclosed control. So wherever possible it is usually economical to locate all control in a pressurized room ventilated with safe air.

WEATHERPROOF MOTORS AND CONTROL

Outdoor locations in localities with very severe weather, hard driving rain, sleet, sand, snow, etc. would indicate totally-enclosed fan-cooled motors and weather-resistant or water-tight control enclosures. Where weather conditions are milder, splash-proof motors usually give adequate protection against the elements. A splash-proof machine is an open machine with ventilating openings so constructed that drops of liquid or solid particles falling on the motor or coming towards it in a straight line at any angle not greater than 100 deg. from vertical cannot enter the machine. The splash-proof design is considerably cheaper than the totally-enclosed fan-cooled and explosion proof motors. Therefore the application should first be reviewed as to possibilities of using splash-proof construction before arbitrarily going to the more expensive units.

Many process plants have no problem of hazardous atmospheres and can use standard open motors and general purpose control. Most modern open motors are designed as drip-proof machines so that drops of liquid or solid particles falling on the motor at any angle not greater than 15 deg. from vertical cannot enter the machine. Sheet steel control boxes prevent accidental contact with the control apparatus and serve as protection against light indirect splashing. They are for indoor use and give some protection against dust but are not dust tight.

Table V compares relative costs of motor and control enclosures based on squirrel cage motors and across-the-line control equipment of the simplest type:

Certain areas are considered as being hazardous only under abnormal

Table V—Relative Costs of Enclosures

Enclosure	Approximate Relative Cost
For Motors	
Open—drip-proof.....	100%
Splash-proof.....	100
Tot. encl. fan-cooled.....	145
TEFC Expl. proof.....	185
For Controls	
Open (panel mtg.).....	100%
General purpose.....	117
Dust tight.....	161
Weatherproof.....	203
Expl. proof (duste).....	240
Expl. proof (vapors).....	316

conditions which would occur very infrequently. Standard open drip-proof squirrel cage motors may be applied in such areas without any form of special enclosure. Wound rotor motors, synchronous motors and direct current machines have slip rings or commutators which are a constant source of sparking. Therefore, these motors must be provided with enclosures around the slip rings for wound rotor and synchronous types and complete enclosures for direct current motors. Control equipment for occasionally hazardous locations must be selected as explosion proof apparatus since contactors, relays, interlocks, etc. may cause a spark at any time.

VENTILATION

On any indoor installation of motors and control careful attention must be given to adequate ventilation to prevent high ambient temperatures in the room due to heat losses in the motors. In some places with large motors it is advantageous to arrange the motor frames for top air discharge so that the heated air can be exhausted outside the building through ducts leading to the roof. Motors are often specified with bottom air discharge so that both air intake and exhaust ducts are under the floor to permit more space for cranes, hoists, etc. above the motors. With smaller motors, the air in the room is usually changed constantly by means of continuous ventilating fans so that the room temperature is held within reasonable limits. All of the ventilating air should be obtained from stacks or pipes located where there is no danger of drawing in contaminated gases of any kind. In some process plants it is necessary to extend stacks 60 ft. high or more to get a source of safe ventilating air.

MOUNTING CONSIDERATIONS

Plant layout can often be simplified by taking advantage of various methods of mounting electrical equipment. Vertical motors or ceiling mounted motors often save space and fit in better with the driven machine or process

location. Flange mountings for motors have been standardized for close coupled drives for pumps, compressors, etc. Such arrangements often prove advantageous where space is limited.

Control can be mounted on the wall or floor near the driven machine for individual motors or can be grouped in a central location or control room remote from the actual drive. Control arrangement must be flexible to permit future additions and must also permit ready accessibility for inspection, repair, and maintenance.

NEMA has standardized on mounting dimensions for all open-type alternating current across-the-line starters rated 600 v. and less. Three holes are provided for mounting, one near the top and two near the bottom in accordance with established dimensions fixed for each starter size.

FRAME SIZES

Motor mounting dimensions have also been standardized so that all motors on a given NEMA frame size will be interchangeable as to bolt holes, shaft height, shaft diameter, shaft length and certain other dimensions regardless of the make of the motor. NEMA frames have been established up to 150 hp. at 3,600 rpm. open construction which would be built on a NEMA 505 frame. This standardization is very helpful where motors are subject to change in location or where a stock of motors is maintained for replacement.

BEARINGS

Bearings are a vital part of every motor drive. Anti-friction bearings are becoming more and more the accepted standard on small and medium sized machines of average speed. As the peripheral velocity increases as with large shaft diameters and high speed operation, sleeve bearings are recommended for good performance and quiet operation. On any high speed centrifugal pump, such as a hot oil pump in a refinery, care must be exercised in selecting bearings and couplings to prevent excessive thrust being imposed on the motor bearings from the pump impeller. This is particularly true with larger motors where sleeve bearings with ample end play should be specified, and limited end float couplings used between the motors and the pumps. Ball bearings will naturally handle more end thrust than sleeve bearings, but in general any thrust imposed on a motor shaft by its load should be checked carefully to make sure that it does not overload the motor bearings causing bearing failures and costly process shutdowns.

World's Chemical Production Score

A quick look shows it's about 4-1 in our favor now.
BUT, what would happen to the picture in case of a third world war with western Europe overrun by Soviets?
AND REMEMBER, Russia puts her military needs far ahead of civilian needs and allots her materials accordingly.

KARL FALK

Chemicals play a decisive role in determining the industrial, and thus the military, potential of the United States and Western powers arrayed at this time against the Soviets and their eastern satellites. What factors go to make up this potential? Could the Soviet chemical industries support protracted large-scale military operations? If western Europe were overrun by the Soviets, how would this affect U. S. ability to carry on a worldwide struggle? These and other questions may be partially answered by trying to draw up a balance sheet of eastern and western strengths and weaknesses in chemicals and related materials.

Such a balance sheet must be viewed with the usual qualifications and reservations. Inadequate information, statistics that vary from country to country in accuracy and comparability, data that do not permit qualitative comparisons, the well-known Russian reserve in revealing information, inability to determine the relative shares of materials devotable to military instead of to civilian needs—these are only a few of the complications that make such an evaluation difficult. Nevertheless, it is still worth a try if we want to know where we stand.

Generally speaking, the picture is good, for the West seems to be able to outproduce the East in chemicals and related materials in a ratio of roughly three or four to one. Realization of this fact may slow down a rationally-acting Politburo since it would indicate a strong possibility of an unfavorable outcome for the Soviets. Similar facts, however, failed to stop the Axis powers from acting up a decade ago. (See *Chem. & Met.*, Jan. 1942: "Our Enemies, Chemically Speaking.")

The relative chemical strength of the leading powers at the outbreak of World War II may be determined by comparing production of major chemicals (see table).

Since 1938 U. S. chemical production has trebled. Meanwhile, wartime destruction and dislocations slowed the Russians down so that despite energetic efforts under the Fourth Five-Year Plan (1946-50) their chemical output by 1950 was only one and three-quarters that of 1938. Thus, the Soviet sphere's postwar chemical output is about equal to prewar Germany's production, and puts the USSR in second place as a world chemical producer. This rise still leaves the Soviets well behind the United States which has trebled, if not quadrupled, capacity since 1938 under the World War II stimulus of supplying her own as well as Allied power needs for chemicals. United Kingdom and France are producing about one-third more chemicals than in 1938 while Italy has reached prewar levels of pro-

duction. Germany, whose partly dismantled capacity was divided roughly in half between eastern and western zones (see *Chemical Engineering*, May 1949, "What Has Happened to Germany's Divided Chemical Industry"), has not reached prewar production, nor has Japan.

Western Europe, that is Britain, France, Western Germany, and Italy, along with the Benelux and Scandinavian countries, have a combined chemical output at present equaling, if not exceeding that of the USSR and its European satellites. Western European industrial production as a whole, partly under ECA stimulus, is about one-quarter higher than before the war.

How would the chemical position be altered if Russia overrun or gained control politically of western Europe? Soviet control of western Europe—assuming widespread destruction did not occur in the process—would narrow the gap in chemical advantage of the U. S. from the present magnitude of three or four to one to about two to one. These are, of course, mere approximations, and naturally many other strategic and logistic considerations besides chemical potentials must be considered in assessing relative East-West strengths. For instance, the percentage of output devoted to war production, admittedly greater under the more rigidly controlled eastern economies, would presumably narrow this gap still more. The amount of chemicals needed to maintain the civilian economy and the relative degree of self-sufficiency of the various countries would be other important factors. That only about a tenth of world chemical output now enters world trade—and roughly half of that comes from the U. S.—shows that there is now a higher degree of chemical self-sufficiency among most industrial nations than before World War II.

Evidence of increasing self-sufficiency and the shifts in world output and world trade in chemicals can be seen in the fact that in the period from 1925-28 to 1945-48 world trade in chemicals (adjusting for price level changes) hardly increased in volume. During the same two decades, while world chemical production was doubling, that of the U. S. increased tenfold. At present only one-tenth to one-twelfth of world output of chemicals enters world trade as against a much higher share in the earlier period when there were fewer major chemical producing countries. The favorable position of the United States is seen by the fact that in having a surplus that permits exporting roughly 10 percent of her chemical production, she now supplies the aforementioned 50 percent of world chemical exports. The United Kingdom and France with 15 and 10 percent, respectively, of world chemical exports are next in importance. For the time being Germany, Italy, and Japan have virtually disappeared as chemical exporters, while Switzerland, Belgium, Netherlands, China, and Argentina are more active in exporting chemicals than they were two decades ago. Eastern European countries on the other hand have lost their former importance. Brazil and Mexico, for example, now export more chemicals than Czechoslo-

DR. KARL FALK sized up "Our Enemies, Chemically Speaking" back in Jan. 1942 for CE readers; now he does a similar job on a worldwide scale. Educated at the University of Berlin; covered Europe for CE from 1932-37; chemical economist for the Dept. of Commerce and OSS during World War II; now head of the Social Science department at Fresno State College.

vakia and Poland. The USSR has never had exportable surpluses of very many chemicals or related products.

The grouping of powers in the World Box Score into (a) U.S., Western Europe, countries whose resources would more likely be available to the West; and into (b) USSR, Eastern Europe, and countries whose resources would more likely be available to the East, is admittedly arbitrary. Military operations in the event of war would determine the validity of these assumptions. Parts of Asia, for example, might still be more available to the West than to the East, where they are grouped in this table. Nevertheless, it gives a rough idea and shows that U.S. leads the USSR in producing 30 to 40 percent of the world's bismuth, cement, coal, coal-tar dyes, coke, copper, fluorspar, salt, zinc; 40 to 50 percent of aluminum, cellulose, electric power, glass, iron ore, pig iron, magnesium,

Production of Major Chemicals in Leading Countries in 1938
(in 1,000 m.t.)

	USA	Ger.	UK	USSR	Jap.	France	Italy
Sulphuric acid.....	5800	1900	990	1500	1750	1270	1100
Soda ash.....	2300	1000	605	530	600	480	382
Caustic soda.....	770	420	403	130	441	125	165
Nitrogen.....	394	915	150	150	423	150	100
Coal tar.....	1500	2000	1000	800	220	450	114
Coal tar dyes*.....	238	490	63	100	37	48	23
Calcium carbide.....	163	763	.....	100	400	170	125
Superphosphate.....	3600	1100	800	1900	1600	1200	1400
Synthetic rubber.....	.....	8	.....	85	.....	.....	.....

* Weighted value index, USSR equals 100.

phosphate rock, rayon, steel, sulphuric acid; 50 to 60 percent of cotton, feldspar, paper and cardboard, petroleum, vanadium; over 60 percent of world output of cadmium, carbon black, molybdenum natural gas, petroleum products, synthetic rubber, and sulphur. On the other hand,

Production Today—World Box Score for Chemicals and Related Materials

(1949—or latest figures available in 1,000 metric tons unless otherwise specified)

WESTERN POWERS

	U. S.	U. K.	France	Italy	Switz.	Dene- lux	W. Ger.	Scen.	Bal. Eur.	Bal. N. Am.	S. Am.	Afr.	Oceania	Jap.	Western Total	% World
Aluminum.....	555	33	64	31	22	—	39	42	—	333	—	—	—	—	1,116	85
Antimony.....	5.5	—	0.2	0.5	—	—	—	—	—	0.3	7	12.6	5	0.2	0.2	31.5
(Sb cont., mine prod.)																
Bauxite.....	1,430	40	780	160	—	—	—	—	—	4,545	140	6	2	7,283	82	
Benzene.....	536	181	90	8	—	87	120	3	11	23	—	—	—	—	1,031	81
Bismuth (m.t.).....	500	—	50	—	—	15	—	12	40	375	380	25	—	4	1,961	90
Cadmium (m.t.).....	3,500	118	20	60	—	188	5	70	—	1,252	2	500	300	20	5,533	96
Calcium carbide.....	630	—	170	165	—	—	522	—	—	135	—	—	—	400	—	?
Carbon black.....	555	4.5	—	—	—	—	18	—	225	—	—	—	—	—	—	?
Caustic soda.....	1,036	450	214	222	15+1	—	231	40	29	—	—	6	12	44	—	?
Cellulose (%).....	49	—	—	—	—	0.5	2	24	—	14	—	—	—	—	—	89.5
Cement.....	35,900	9,500	6,730	7,940	—	2,900	9,130	1,800	6,000	3,700	4,000	2,800	2,200	3,300	98,540	81
Chlorine.....	1,500	—	68	—	—	—	170	—	—	—	—	—	—	—	10	1,437
Chromite.....	145	—	—	—	—	—	—	—	350	225	10	642	75	10	1,437	61
Coal (million).....	300	210	65	2	—	40	190	3	3	18	5	25	16	35	1,302	65
Coal-tar dyes.....	65	209	12	9	10+1	—	18	—	—	—	—	—	—	—	5	141
Cobalt (m.t.).....	300	—	—	40	—	—	100	110	—	700	—	5,000	15	10	6,278	97
Coke (million).....	68	16	10	1.4	—	6.2	34	1	—	4	0.5	0.3	2	3	130.4	72.2
Copper (mined).....	730	—	0.3	40	—	—	1	83	14	295	404	440	13	33	2,103.3	86
Electric power (bil. kWh.).....	336	54	30	23	10	14	41	35	5	47	—	10	9	36	650	80
Feldspar.....	450	1	45	13	—	—	50	80	—	50	109	4	8	25	736	96
Fluorspar.....	300	70	32	40	—	—	38	5	2	185	1	5	1	1	633	90
Iron ore (million).....	90	14	31	4	—	4	9	14	2	3	3	5	2	1	184	81.1
Iron, pig (million).....	50	10	9	0.5	—	7	8	1	1	2.3	1	2	1	2	94.8	77.9
Lead (million).....	400	2	10	30	—	—	40	—	35	375	90	115	200	10	1,327	94.8
Magnesium.....	10	5	1	0.5	0.5	—	311	1	—	—	—	—	—	—	18	74
Manganese ore.....	115	18	—	45	3	—	90	25	10	100	280	1,400	5	100	2,191	43.1
Mercury (m.t.).....	486	—	—	1,530	—	—	—	—	1,920	300	15	38	—	36	4,545	83
Molybdenum (ore & conc.).....	12,300	—	—	—	—	—	—	200	—	300	500	—	—	30	13,220	97.4
Natural gas (bil. cu.m.).....	138	—	0.2	0.2	—	—	—	0.1	—	2.6	13.3	—	—	—	154.4	97.3
(consum.)																
Nickel.....	1	—	—	—	—	—	—	—	119	0.5	0.5	0.5	5	—	127	83.2
Nitrogen (fert. N).....	1,070	300	215	130	15	280	425	150	100	180	300	15	10	300	3,510	83
Paper & cardboard (%).....	50	6	3	—	—	1	3	—	—	10	1	—	—	—	—	?
Petroleum (million) (crude).....	290	2	—	—	—	—	1	—	—	13	78	2	—	—	387	76.8
Petroleum (thous. bbl.).....	1,874	30	78	21	—	31	10	3	2	138	395	4	66	1	2,650	88.5
(major refined prod.)																
Petroleum (thous. bbl.).....	962	8	22	5	—	7	4	1	—	54	82	1	23	—	1,169	92.8
(motor fuels)																
Phosphate rock (P ₂ O ₅).....	6,300	30	180	2	—	10	—	50	23	—	150	6,700	300	4	16,639	84
Plastine.....	700	30	100	8	8	15	18	1	—	—	—	—	—	—	—	?
Platinum group (M troy oz.).....	23	—	—	—	—	—	—	—	—	343	40	92	0.1	—	498.1	79.6
Potash (K ₂ O).....	1,000	—	700	—	—	—	700	—	200	—	—	—	—	—	3,100	63
Pyrite (B).....	400	10	100	453	—	—	200	550	1,300	100	—	25	55	600	3,595	72.5
Rayon & staple fiber.....	310	106	77	90	18	47	135	24	1	19	20	—	—	32	1,069	86.8
Rubber, natural.....	600	195	92	740	710	720	80	720	7110	80	710	730	26	80	1,293	85
(consumption)																
Rubber, natural.....	—	—	—	—	—	—	—	—	—	—	—	4	42	—	46	2.8
(production)																
Rubber, synthetic.....	500	—	—	—	—	—	—	—	40	—	—	—	—	—	540	70
(production)																
Salt.....	14,800	2,300	2,500	700	100	300	2,000	—	1,000	1,000	1,200	800	230	350	28,200	68.9
Soda ash (Na ₂ CO ₃).....	1,936	—	281	280	—	—	800	40	100	—	—	10	12	43	3,374	?
Shed (ing. & coatings).....	78	16	11	2	—	7	9	2	1	4	1	2	1	3	137	77.2
Sulphur (native).....	4,900	—	60	290	—	—	—	—	14	3	26	15	—	60	8,278	98
Sulphuric acid.....	9,000	1,900	1,200	1,700	—	300	930	380	300	930	275	150	300	930	18,875	85
Superphosphate (P ₂ O ₅ cont.).....	4,000	1,200	1,200	—	—	—	—	—	—	—	—	—	—	—	6,400	?
Tin Ore.....	—	1.3	—	0.1	—	—	—	—	4.5	1	38	22	2	0.1	69.0	42.6
Titanium (m.t.) (ilmenite).....	368.8	—	—	—	—	—	88.4	—	4.06	8.1	5.08	5.08	—	—	479.6	60
Tungsten (m.t.) (WO ₃).....	2,200	45	200	5	—	—	200	2,230	825	2,800	425	750	10	10	9,480	43
Vanadium (m.t.).....	2,500	—	—	—	—	—	—	—	850	1,000	—	—	—	—	4,350	99
(Cu ore & conc.)																
Zinc (mined).....	600	3	10	60	—	—	50	43	45	420	90	80	171	40	1,612	84

¹ Estimated. ² Exclusive Peru. ³ Estimated raw.

Value of Output
Leading Countries, 1938
(U.S.A. = 100)

1. United States.....	100
2. Germany (Old Reich).....	72.5
3. United Kingdom.....	28.8
4. USSR.....	27.5
5. Japan.....	18.8
6. France.....	18.6
7. Italy.....	13.8

* Chemie-Ingenieur-Technik,
Aug. 14, 1950.

Value of Output, Soviet
Sphere, 1950
(USSR = 100)

USSR.....	100
Germany (Soviet Zone).....	19.5
Poland (incl. former German areas).....	9.8
Czechoslovakia.....	9.7
Hungary.....	3.7
Rumania.....	1.7
Bulgaria.....	.3
Total Soviet Sphere.....	141.6

phuric acid output. The box score shows the U.S. out-produces the USSR in sulphuric acid four to one, in steel three to one, in coal two and a half to one, in coke over two to one, in petroleum eight to one, and in nitrogen four to one.

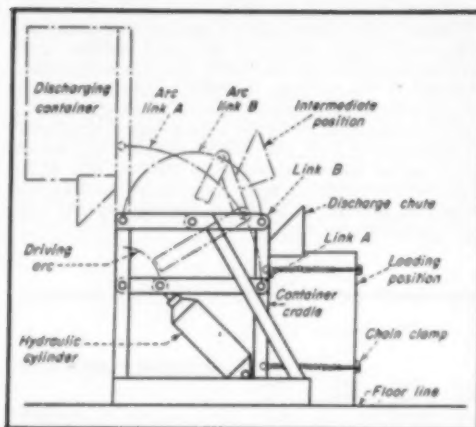
Whereas United States enjoys a qualitative advantage in having more highly developed integrated chemical and processing industries than the USSR, the latter enjoys some advantages in raw materials, especially in minerals such as manganese for which Russia is the world's leading producer. In 1939, for example, listing the relative degrees of mineral self-sufficiency of U.S. and USSR indicates, the Soviet Union had an over-all advantage in minerals over U.S. when their consumption needs were related to domestic production, although U.S. led in smelting capacity and development of resources.

the USSR leads the U.S. in the production of chromite, gold, manganese ores, nickel, platinum, and pyrites, as well as propaganda.

Probably the best single indicator of relative industrial production between United States and the USSR is sul-

EASTERN POWERS

% World Total	Eastern Total	U. S. S. R.	E. Ger.	Pol.	Czech.	Balk.	China	Near East	Ind., Pak.	Isl. Asia	
12.6	178	140				30	3		5		Aluminum
28	12.5	3	0.1		2	2	4		0.4	1	Antimony (50 cent. mine prod.)
16.6	1,420	500				500			20	400	Bauxite
18	222	150 ^a	7	36	30	9					Benzene
15	225	100 ^a	15				10			100	Bismuth (m.t.)
3.4	200	100		100							Cadmium (m.t.)
7	355		192	162		1					Calcium carbide
7		1.8									Carbon black
10	639	390	150	47		36	20		18		Caulic soda
17		8	1		1	1				3	Cellulose (%)
17	20,840	10,000	1,230	2,200	1,640	2,800	750		2,100		Cement
38	890	515				75			50	250	Chlorine
32.5	600	245	150	75	45	20	15		30	20	Chromite
23	45	40		3	1	1					Coal (million)
8		7					100			100	Coal tar dyes
37	51	30	5	6	7	1			2		Cobalt (m.t.)
9	299	225	1	1	40	1			6	25	Coke (million)
17	140	90	11	11	13	15					Copper (mined)
2.7	21				7	3			1	10	Electric power (bil. kwh.)
18.4	152	100				72				50	Feldspar
17.8	40.5	25		1	1.5	3	5		3	1	Fluorapar
19.9	25.3	17	0.3	2	2	1			2	2	Iron ore (million)
13.8	222	100+	20	15	2	60	1			25	Iron, pig (million)
30.3	7.5	3	1						0.5	1	Lead (mined)
36.2	2,810	2,200				10			675	25	Magnesium
15.5	856	500			30	326					Manganese ore
3	7400						7400				Mercury (m.t.)
2	3.2	3		0.2							Molybdenum (ores & conc.)
16.3	25.5	25				0.5					Natural gas (bil. cu m.)
17	740	275	180	100	35	90	10		10	50	Nickel
16		12	1		1	1			1		Nitrogen (fert. N)
21.2	105	35				0		53	1	11	Paper & cardboard (%)
?		?	?	?	?	?	1	305	2		Petroleum (million) (crude)
?		?						65	1		Petroleum (thous. bbl.)
13.2	2,741	2,500		20		20			1	200	Petroleum (thous. bbl.)
?		8									(motor fuels)
20	125	125									Phosphate rock (P ₂ O ₅)
34	1,700	700	850	100					5	45	Plastics
25.6	1,405	1,200	100	18	2	35	25			25	Platinum group (M troy oz.)
12.2	151	151	76	18	25	17					Potash (K ₂ O)
12.3	207	110	735	710	715	719	75	2	75	715	Pyrites (S)
97.66	1,554	1							25	1,558	Rayon & staple fiber
30	230	200	30								Rubber, natural
28.1	11,050	4,300	1,000	690	150	300	1,900	300	2,400	1,000	(consumption)
?	1,006	800	100	45	35	35	20		6		Rubber, natural
21.2	38	27	1	9	3	2			2		(production)
32				12	1	2				17	Salt
12.6	2,780	2,000 ^a	200	150	190	100	50		90		Soda ash (Na ₂ CO ₃)
?	3,285	3,000 ^a		285							Steel (Ing. & castings)
37		?					5			88	Sulphur (native)
37		?							270	20	Sulphur (acid)
55	11,510	?					10,000		10	1,500	Superphosphate (P ₂ O ₅ cont.)
?		?									Tin ore
15	288	110	50	90	3	35					Titanium (m.t.) (ilmenite)
											Tungsten (m.t.) (W ₂ O ₃)
											Vanadium (m.t.)
											(Cu ores & conc.)
											Zinc (mined)



Hydraulic Discharger for Containers Is Safe, Simple and Portable

W. L. PATTON, Development Engineering Division, Chambers Works, E. I. du Pont de Nemours & Co., Penn's Grove, N. J.

May Contest Prize Winner

Use of a container discharging device in a chemical plant frequently imposes severe design restrictions. The mechanism must be as compact as possible with reference to head room as well as floor area. It should be portable and require minimum set-up time, since economic justification cannot normally be fulfilled by a single fixed installation. It must operate safely under potentially explosive conditions. The rate of discharge should be controllable and the container should be completely inverted by the mechanism.

The design shown in the sketch above was developed to meet these conditions. It achieves compactness and complete inversion by use of a double linkage. The longer link A is the driven member which is actuated by a hydraulic cylinder. The shorter link B is a restraining member which is used to invert the drum. The pivot locations and the lengths of these two links determine the location of the discharge point, the amount of inver-

sion, and the point in the container motion where inversion begins.

Since water lines are generally available in the plant, a hydraulic cylinder is used to give a smooth, controllable motion without risk of explosion hazard. Proper sizing of the feed and discharge lines provides a cushion in case of pressure failure. Adjustable flow control valves may be triggered during any desired portion of the motion to control the rate of discharge.

For ease in transporting the unit, the frame is designed to fit standard fork trucks and hand transporters. Stability can be rapidly obtained by pinning the frame to anchor plates at the operating location. Plug-in couplers at these locations provide for rapid coupling and uncoupling to the water-line connections. Chain clamps permit rapid fastening of the container into its cradle.

How to Calibrate Non-Standard Tanks With Standard Tank Tables

GEORGE W. PREHLER, Plant Superintendent, Cochrane Chemical Co., Matawan, N. J.

Recently it was the writer's task to calibrate a large number of horizontal, cylindrical tanks with dished ends. My first thought was to use one of the tables for standard sizes of horizontal tanks, such as appear in Kent's "Mechanical Engineers' Handbook," in Marks' Handbook or in Perry's Handbook. For the dished ends I planned to use the tables prepared by Lukens Steel Co. However, it was evident that most of the tanks were not standard and to calculate the contents from the fundamental relations for each $\frac{1}{4}$ in. of depth would require working to six significant figures to approximate the accuracy of the standard tables.

It is possible to secure the desired results, however, and bypass the huge volume of calculations otherwise needed, by recognizing that proportion can be applied to the standard tables. That is, if two tanks of different diameters have the same ratio of liquid depth h , to tank inside diameter D , then the volumes of liquid in the two tanks are as the ratio of the squares of their diameters. The same applies to the contents of dished heads of similar geometric form, except that the relative volumes are as the ratio of the cubes of their diameters. The calculations can be carried out with a slide rule, with an accuracy of 0.2 percent (or better with a calculator). An example will make the method clear.

★ June Contest Prize Winner

"Simple Manostat Controls Vacuum Operation With High Degree of Accuracy."

A prize of \$50 in cash will be awarded to Arthur W. Werry, junior chemical engineer with the Amino Division of International Minerals & Chemical Corp., San Jose, Calif. His article will appear in August.

\$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering* will award \$50 cash each

month to the author of the best short article received that month and accepted for publication in the *Plant Notebook*.

The winner each month will be announced in the issue of the next month, e.g., the July winner will be announced in August and his article published in September. Judges will be editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at space rates.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other

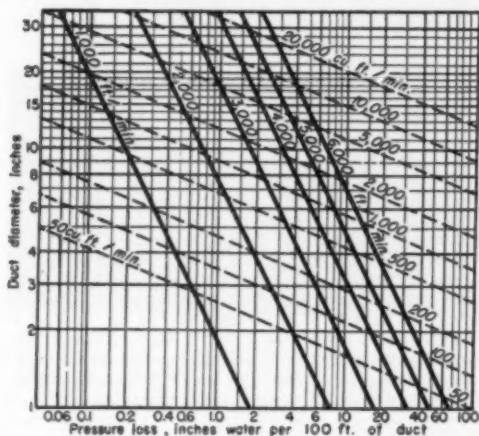
than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible.

Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries. Also, novel means of presenting useful data are acceptable. Address *Plant Notebook* Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

Suppose that a 130-in. tank is to be calibrated. At a depth of 47½ in., what is the capacity of the cylindrical portion per foot of length? Here $h/D = 0.363$. Referring to the table in Kent's where the largest tank listed is 120-in., the depth corresponding to this same h/D is 43.6 in. Interpolating, the capacity per foot of length at $h = 43.6$ in. in a 120-in. tank is 192.85 gal. Then $(130/120) \times 192.85 = 226$ gal. per foot of length for a 130-in. tank for the cylindrical portion, filled to a depth of 47½ in.

To obtain the volume of one dished head, we refer to the Lukens table for a 120-in. tank. Here again the proportional depth is 43.6 in., and interpolation gives a capacity of 112.3 gal. Then $(130/120) \times 112.3 = 143$ gal. for one 130-in. dished head filled to a depth of 47½ in.

In the shallow portions of the tank (lower 10 percent) interpolation can be avoided by using proportion, if the greatest accuracy is not needed. For example, a 7-in. depth in an 84-in. tank is proportional to a 6-in. depth in a 72-in. tank, which can be taken from the table without interpolation as 8.42 gal. per foot. Hence, $(84/72) \times 8.42 = 11.45$ gal. per foot of length for 7-in. depth in an 84-in. tank. The interpolated figure is 11.60. Furthermore, interpolation can often be avoided by skillful selection of data from the tables. For example, a 24-in. depth in a 66-in. tank is very nearly proportional to a 47½-in. depth in a 130-in. tank and so can be used without interpolating. In any event, however, data from the larger size tanks are preferable, since they are given to five significant figures, while only three significant figures are given for the smaller sizes.



Simplified Graph for Air-Duct Pressure Loss

B. HORNUNG, Consulting Engineer, B. Hornung & Associates, Montevideo, Uruguay.

Although it is not a substitute for accurate calculation from proper data, the accompanying chart gives a good, quick check on the pressure loss in air ducts. Its results are much better than the usual rough guess or rule-of-thumb, and much better than the shortcut so often used of making ducts the same size as the connecting flanges of the fan, without effort at calculation.

The chart has been developed by the author from data published by the Power-Gas Corp., Ltd., of Stockton-on-Tees, England. On an all-logarithmic scale, which gives comparable accuracy at all points, its abscissas are units of pressure loss, in inches of water per 100 ft. of duct, and its ordinates are diameters of cylindrical ducts, in inches. The solid sloping lines represent flow velocity, and the dashed lines, volume flow rate.

As an example assume that a ventilating fan is to remove 200 cfm. of air from a process room, through duct equivalent to 50 ft. of straight duct, at a pressure loss of 1 in. of water. A loss of 1 in. per 50 ft. is equivalent to 2 in. per 100 ft. Therefore, enter the chart vertically at 2 in. pressure loss and intersect the flow rate of 200 cfm. Travelling horizontally to the left, we find that a duct of 4 in. diameter meets the need. Incidentally, we find the flow velocity to be just over 2,000 ft. per min. Conversely, if we want to find the fan needed to give 2,000 ft. per min. in a duct to prevent dust settling, when duct size is 4 in. and the length is 100 ft., then the fan must provide for a pressure loss of 2 in. of water.

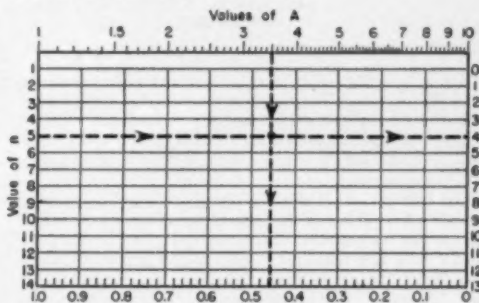


Chart for Rapid Logarithmic Reciprocal Calculations

J. T. HOGAN and D. M. BATSON, Chemical Engineers, New Orleans, La.

Many chemical calculations require the solution of equations containing logarithmic reciprocal relationships. For most purposes such functions are conventionally calculated with the aid of a table of logarithms or slide rule, or both. That this calculation is time-consuming was realized by Sanz,¹ who showed how an ordinary slide rule may be used to obtain the digit factor of logarithmic reciprocal functions, the exponential factor being found by inspection or memory.

The chart presented here readily solves the equation

$$Y = \log [1/(A \times 10^{-n})]$$

for values of n from 1 to 14, inclusively, without the use of logarithms or the slide rule. For purposes of illustrating the use of the chart consider the nomographic solution of the equation $Y = \log [1/(3.5 \times 10^{-4})]$. Enter the top horizontal scale at the value 3.5 and proceed vertically downward to the intersection of this value with $n = 5$ on the left-hand vertical scale. This point represents the value of Y , which is defined by the intersection of the values 4 and 0.46 taken from the right-hand vertical scale and the bottom horizontal scale, respectively. Therefore, $Y = 4 + 0.46 = 4.46$.

By reversing the foregoing procedure the chart may be used to solve the equation $\log [1/(A \times 10^{-n})] = 4.46$.

Chemical calculations dealing with pH, molarities and

ionization constants are readily solved by means of the chart.

Conversion of pH to Terms of Hydrogen-ion Concentration—Given $pH = 4.23$, to find $[H^+]$, the number of gram-atomic weights of hydrogen ions in one liter of solution. To solve, enter the right-hand vertical scale at the value 4 and proceed to the left to the intersection of this value with 0.23 read along the bottom horizontal scale. This point is defined by the values 5.9 and 10^{-5} taken from the top horizontal scale and the left-hand vertical scale, respectively. Therefore, $[H^+] = 5.9 \times 10^{-5}$.

By reversing the foregoing procedure the chart may be used to find the pH equivalent to any given value of $[H^+]$.

pH Values, Molarities and Ionization Constants of Weak Acids and Bases—The concentration of the ions of weak electrolytes cannot be calculated by methods as simple as those used for strong electrolytes, for in solutions of weak electrolytes there are always at any given moment some un-ionized molecules of the electrolyte. Thus, the law of mass action must be applied to obtain the required information. For a weak acid the following relationship can be shown²

$$2 pH = pK_a + pM$$

where $pH = \log 1/[H^+]$; H = hydrogen-ion concentration; $pK_a = \log 1/K_a$; K_a = ionization constant of acid; $pM = \log 1/M$; and M = molarity of the acid.

The chart lends itself to the solution of the above equation with the aid of a few simple arithmetical additions and subtractions.

For example, at 25 deg. C. the pH of a citric acid solution is 1.87. What is the concentration of the solution? The ionization constant of citric acid is 8.0×10^{-4} at 25 deg. C. To solve note that $2pH = pK_a + pM$ or $pM = 2pH - pK_a$. Since the pH is given, the value of the term $2pH = 2 \times 1.87 = 3.74$. The value of $pK_a = \log [1/K_a] = \log [1/(8.0 \times 10^{-4})]$ is obtained from the chart directly. Enter the top horizontal scale at 8.0 and proceed downward to the intersection of this value with $n = 4$ on the left-hand vertical scale. This is the value of pK_a , which is defined by the values 3 and 0.10 taken from the right-hand vertical scale and the bottom horizontal scale, respectively. Therefore, $pK_a = 3 + 0.10 = 3.10$. Now, $pM = 2pH - pK_a = 3.74 - 3.10 = 0.64$.

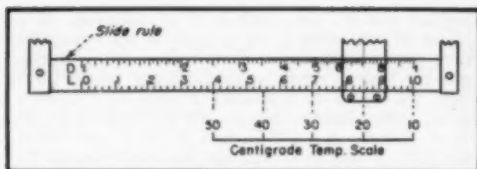
Enter the chart at the value 0 on the right-hand vertical scale and proceed to the left to the intersection of this value with 0.64 on the bottom horizontal scale. This point M is defined by the points 2.3 and 10^{-3} on the top horizontal scale and the left-hand vertical scale, respectively. Therefore, $M = 2.3 \times 10^{-3} = 0.23$ molar.

The concentration of $[OH^-]$ in solutions of weak bases may be calculated in a similar manner. The relationship will then be expressed as $2 pOH = pK_b + pM$ where K_b = ionization constant of the weak base. It is interesting to note that for 1 molar (1M) solutions the above equations reduce to $2 pH = pK_a$ and $2 pOH = pK_b$, since $pM = 0$ for 1 molar solutions.

The use of the chart for the solution of a few routine chemical calculations illustrates the possibility of adapting it to the specific application at hand. As in the present chart, the alignment of a logarithmic chart or scale with an equidivisional scale may suggest a number of other novel charts for routine calculations involved in various exponential or logarithmic relationships.

REFERENCES

1. Sans, M. C., *Ind. Eng. Chem., Anal. Ed.*, **5**, 218 (1933).
2. Forgan, N., and Clark, T. F., *J. Chem. Ed.*, **17**, 571-573 (1940).
3. Clark, W. M., "The Determination of Hydrogen-Ions," Williams and Wilkins Co., Baltimore (1928).



Viscosity of Water Between 5° and 70° C.

D. S. DAVIS, Virginia Polytechnic Inst., Blacksburg, Va.

Eckhardt¹ and the author² have shown how the slide rule can be used for a number of rapid calculations of an unusual nature, once convenient relationships between variables have been established. The requirements of such handy equations are: (1) simplicity; (2) accuracy; (3) constants that can be expressed in two significant figures that are easily remembered; (4) an easily recognizable relationship between the constants; and (5) adaptability to slide rule computation.

It is the purpose of this note to show how the viscosity of water can be satisfactorily estimated between 5 and 70 deg. C. by means of the following simple equation which is well adapted to slide rule manipulation for the range between 10 and 50 deg. C.:

$$\log (\mu - 0.30) = 0.15 - 0.015 t$$

where μ = viscosity of water, in centipoises, and t = temperature, in deg. C.

Observed and Calculated Viscosities of Water

Temperature, Deg. C.	Obs'd. Viscosity	Calc'd.	Percent Deviation
5	1.519	1.488	-2.0
10	1.308	1.300	-0.6
20	1.005	1.008	0.3
30	0.801	0.801	0.0
40	0.650	0.655	-0.2
50	0.549	0.551	0.4
60	0.469	0.478	1.9
70	0.406	0.398	-2.0

The tabulation gives a comparison of the accepted values of viscosity with values calculated by means of the equation, and shows that calculated and accepted values agree within 0.3 percent between 10 to 50 deg. C., and within 0.9 percent between 5 and 70 deg. C.


Between 10 and 50 deg. C. viscosities can be read off a slide rule through the use of the L and D scales as follows: Let 10 on the L scale correspond to 10 deg. C., 8.5 to 20 deg., 7 to 30 deg., and so on. Opposite 10 on L read 1 on D. To 1 add 0.300 to obtain 1.300 in place of the correct 1.308. Similarly, opposite 8.5 on L (corresponding to 20 deg. C.) read 0.708 on D which, when increased by 0.300, gives 1.008 rather than 1.005.

REFERENCES

1. Davis, D. S., *Chem. Met. Eng.*, **51**, 115 (July 1944).
2. Eckhardt, Henry, *Chem. Eng.*, **87**, 119 (July 1950).

Conserving Electric Heating Elements

In the most recent issue of its periodical, *Electric Heat in Industry*, General Electric Co. has some good advice for users of electric heating elements. Such elements fail through burn-out most frequently on account of overheating due to faulty use or installation. Immersion heaters must be fully immersed, to the depth specified, usually about 2 in. over the element. Strip and tubular heaters that are to be insulated should be installed in an air space in contact with the surface to be heated, but not in direct contact with the insulation.



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35,000 volt brush test—enough voltage to track down any slight, unsuspected weakness up to eight inches away. In another test, a piece from the same batch of rubber, bonded and vulcanized at the same time as the lining, is sent to the ACE laboratory for complete breakdown tests. To be sure of the protection you buy, be sure to specify ACE.

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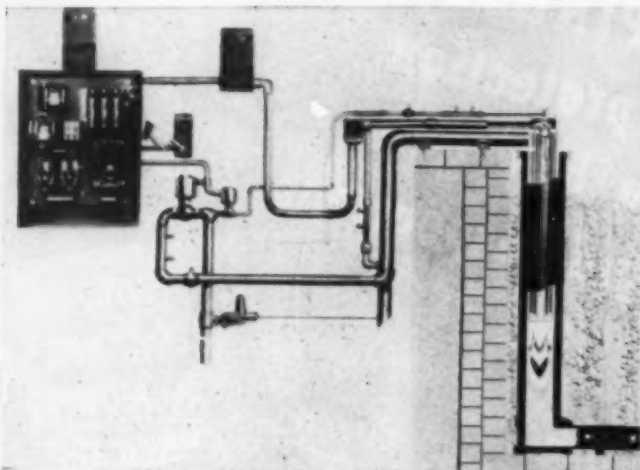
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HEATING & EVAPORATION	144	FLUID FLOW	152
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HEATING & EVAPORATION . . .



PUSH A BUTTON and this automatic control system will purge, ignite, and maintain maximum combustion efficiency.



CALCIUM CHLORIDE solution^{*} is evaporated in this tank.

Submerged Combustion Now Fully Automatic

Process permits heating and concentration of scale-forming or corrosive solutions.

(144A) A new submerged combustion heating and evaporating system, designed by the Submerged Combustion Co., is said to be completely automatic in startup and operation. All you do to put the entire unit into operation is merely press a button.

The system consists of a gas-fired burner, compressed air supply, and a series of controls. When the starting button is pushed, the air compressor starts up and delivers a pressure sufficient to overcome the head of liquid in the tank, purging the combustion chamber of liquid.

The igniter, meanwhile, is being heated to incandescence by the passage of a high amperage, low voltage current. After it is up to kindling temper-

ature, a flow of pilot gas is admitted to the burner, where it is ignited. The main gas flow is then passed into the burner. The air-gas ratio is automatically controlled to give maximum combustion efficiency.

Submerged combustion has been the open sesame to many evaporation processes which would otherwise be uneconomical or impractical. It is especially suited for concentrating solutions which are scale-forming or corrosive. The earliest reported use of submerged combustion evaporation was for sodium sulphate solutions. More recent applications involve magnesium chloride, calcium chloride, phosphoric acid, sulphuric acid, and citrus wastes.

Submerged combustion, as the name implies, is the burning of a gaseous fuel in a simple burner completely immersed in the liquid being treated—the combustion products are discharged directly from the burner into the liquid. Any combustible gas, either natural or manufactured, can be used. The process can be used with any tank, including those made of wood or ceramics.

Evaporation by submerged combustion provides temperature conditions equivalent to evaporation under partial vacuum. This is because the non-condensable CO₂ exerts a partial pressure in proportion to its concentration in the vapors leaving the tank. The partial pressure of the water vapor, on this account, will be appreciably less than one atmosphere. Submerged combustion thus provides a means for

concentrating solutions containing heat-sensitive substances without requiring reduced pressures.

Other uses of submerged combustion are: (1) Recarbonation of water to eliminate supersaturation of CaCO_3 by converting to the bicarbonate; (2) heating of aqueous solutions where concentration of the solution is not desired; (3) concentration of suspensions to facilitate disposal, such as sewage and industrial wastes.

LITTLE ATTENTION REQUIRED:

Dehumidifier

(145A) Abbecon Supply Co. says that a new dehumidifier, now coming off the production line, will dehumidify any closed area of tight construction up to about 8,000 cu.ft. The unit employs refrigeration to condense moisture from the air. The moisture collection pan may be emptied by hand about once a day or a hose or pipe may be connected for discharge of condensate.

Air flow through the unit is 110 cfm. It operates on 115-v., 60-cycle a.c. Weighing 55 lb., it is priced at about \$150.

NO SORTING REQUIRED:

Tube Bundles

(145B) A new method of packaging U-bend tubes for heat exchangers has been developed by Wolverine Tube Div., permitting installation direct from shipping pallet to heat exchanger upon receipt by the customer.

Hertofore, U-tubes with different bending radii were shipped in separate packages. You had to sort and nest the tubes before you could install them in your exchanger.

Wolverine's new method of packaging spares you this sorting and assembly time. U-tubes will now be nested according to customer prints and palletized by the shipper.

USES A PRESSURE ATOMIZER:

Humidifier

(145C) Development of a new heavy-duty, high-capacity humidifier has been announced by Daffin Mfg. Co. The new unit, Hum-O-Zone Model 300-B, uses a high-pressure pump to disperse water through special nozzles. It will discharge approximately 1,200 cfm. of humidified air.

The humidifier is fully adjustable; moisture output may be controlled to fit individual requirements. No water drain is necessary because the tank level is controlled by a float.

The unit is powered by a 1/3-hp. motor and requires only a cold water supply and a 110-v. a.c. source in most installations.

FOR UNPLUGGING HEAT EXCHANGERS:

Tube Cleaner

(145D) A new tube cleaner, Model TP-301, has been brought out by Thomas C. Wilson. Operated by air pressure as low as 50 psi., this cleaner is said to remove deposits rapidly and economically from completely plugged heat exchanger tubes. It will work on tubes from 1/4 in. up to 3 in. O.D.

Hollow shafting is available in one piece up to 20 ft. or in sectional threaded lengths, if desired. The cleaner itself weighs only 15 lb.



COMPACT AND RUGGED:

Water Coolers

(145E) Information has been released by Young Radiator Co. on an improved line of engine jacket water coolers. These welded steel units are said to be more compact and more rugged in construction than their predecessors. They are designed to resist vibration and last the life of the engine.

In the new coolers, gas and/or lube oil cooling coils may be mounted between the fan and the water cooling core. The fan cools these coils first, with a minimum rise in air temperature, little affecting the cooling of the water. This arrangement makes possible a lower fan horsepower requirement than conventional arrangements, says Young.

FOR LABORATORY APPLICATIONS:

Steam Generator

(145F) Palo Laboratory Supplies has introduced a miniature automatic steam generator designed for laboratory uses which require steam.

It is made in four sizes, according to capacity required. The smallest size has a water capacity of 2 gal., weighs 140 lb., is priced at less than \$200.

Starting with a cold boiler, the generator can deliver full steam pressure within 20 min. Heating is provided by submerged electrical elements. Working pressure is 100 psi.

PACKAGING & HANDLING . . .

FOR HAND OR TRUCK OPERATION:

Self-Dumping Trailer

(145G) A self-dumping, 1-cu. yd. capacity trailer has been added by Phillips Mine & Mill Co. to its line of industrial materials handling trailers. This new item, designated Model SRF-1 Phil-Dump, can be pushed by hand or handled by a fork lift truck.

The self-dumping hopper is held by a safety lock with a safety catch, preventing accidental dumping. Balance of the hopper is such that when the lock is released the hopper dumps its load and then returns to the loading position. The lock then automatically engages, holding the hopper in place.

Without danger of tipping over, it can be dumped from a fork lift truck in the elevated position. This feature is valuable in such operations as loading gondola cars.

LIFTS AND DUMPS:

Portable Skip Hoist

(145H) The Upanover, a portable skip hoist, is custom built to lift and dump the contents of almost any
(Continued)

Equipment Cost Indexes

(Marshall and Stevens Indexes of Comparative Equipment Costs, 1934 = 100)

Industry	June 1950	Mar. 1951	June 1951
Average of all.....	162.1	181.2	189.9
Process Industries			
Cement mfg.	153.1	174.9	173.1
Chemical	166.1	182.0	181.1
Clay products	152.1	169.0	168.1
Glass mfg.	156.2	172.1	171.2
Paint mfg.	159.4	175.3	174.4
Paper mfg.	159.7	175.6	174.7
Petroleum ind.	162.5	178.4	177.6
Rubber ind.	164.9	180.5	179.9
Process ind. avge.	162.5	179.4	178.5
Metal Industries			
Elec. power equip.	167.7	183.6	182.7
Mining, milling	166.8	182.7	181.8
Refrigerating	179.4	201.0	200.5
Steam power	164.8	171.2	170.3

Compiled quarterly for March, June, September, and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, *Chemical Engineering*, Nov. 1947, pp. 134-8. For a listing of annual averages since 1913 see *Chemical Engineering*, Feb. 1951, p. 158.

NEW EQUIPMENT, cont. . .

container or any bulk material which will flow at an angle less than 60 deg. Units are made to specification by Jacob House & Sons.

Units are designed in accordance with the nature of the material to be dumped, the container, the receptacle, and power specifications. Basic models are rated at load capacities of 150 to 1,000 lb.

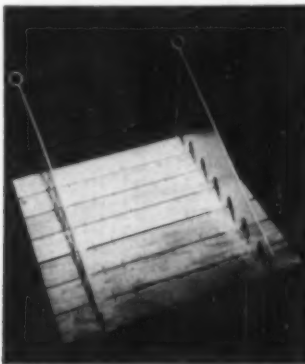
Lifting is done by two flexible cables. Tilting is accomplished by restraining the upper or pouring end of the skip while the lifting pivot point continues to move upward until the channel-guided slide block trips the upper limit switch. The balance point of the skip is determined by actual test after the skip is built.

Portability is provided by equipping the base with casters.

BEAT THE STEEL SHORTAGE: Barrel Washer

(146A) A new power-driven barrel washer built by Emerson-Scheuring Tank & Mfg. Co. provides a quick, low-cost method of cleaning steel drums so that they can be reused. The standard washer, made of heavy steel plate, holds five drums at a time.

The drums, loaded with several short lengths of sharp chain, are two-thirds immersed in a hot caustic solution. Combined chemical and mechanical actions quickly remove accumulated paint and dirt. Large steam coils, extending the entire length of the tank, maintain the cleaning solution at proper temperature.



NEW HANDLING TECHNIQUE: FORKLESS PALLET AND HOOK TRUCK

(146B) A new handling method introduced by Automatic Transportation Co. uses a pallet that can be handled by an industrial truck equipped with hooks instead of forks. The new method saves vertical storage space because the pallets

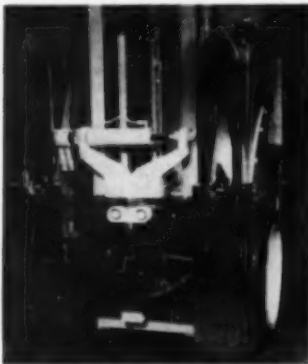
Capacity of the standard size washer is about 160 lacquer drums per 8-hr. day. Enamel, agitator type, or other hard-to-clean drums require more time. The washer can be operated by one to three men, depending upon the work load, it is said.



ELIMINATES TILTING: Dump-Bottom Box

(146C) Introduced by Union Metal Mfg. Co. at the recent Materials Handling Exposition, a new dump-bottom box is said to permit precision dumping with virtually complete spillage control. The loaded box is picked up and carried to the point of discharge by a fork lift truck. The truck operator discharges the load at the precise height and location desired.

Dumping is effected by means of a hydraulic attachment jointly developed by Union Metal and Clark Equipment Co. engineers. The mechanism can be



are only 1-in. thick, compared with the 6-in. depth of standard pallets. Aisle requirements, too, are reduced by the absence of forks. Automatic has developed a versatile truck, using forks that hinge in a vertical position.

applied to almost any hydraulically operated fork lift truck.



HANDLES WITH CARE: Oscillating Conveyor

(146D) Link-Belt Co. has developed a new conveyor, called the Flexmount, for handling a great variety of loose bulk materials at moderate capacities. The new conveyor uses a one-piece metal trough oscillating at the natural frequency of its flexible mountings. Motion is imparted to the trough by a roller-bearing, constant stroke eccentric, driven at selected speed.

Uniform, continuous flow is provided, regardless of overloads or surges, it is claimed. Action is said to be so gentle and easy that there is no degradation of thin or brittle material.

Conveyor trough, normally 4-in. deep, can be furnished in standard widths of 8 to 24 in., made of No. 10 or 12 gage steel, stainless steel, or other special materials. Troughs can be furnished in lengths up to 100 ft. Dividers can be installed to handle several materials simultaneously in the same conveyor. Escape of dust or gases can be eliminated by the addition of a metal cover with flexible connections at loading and discharge points.

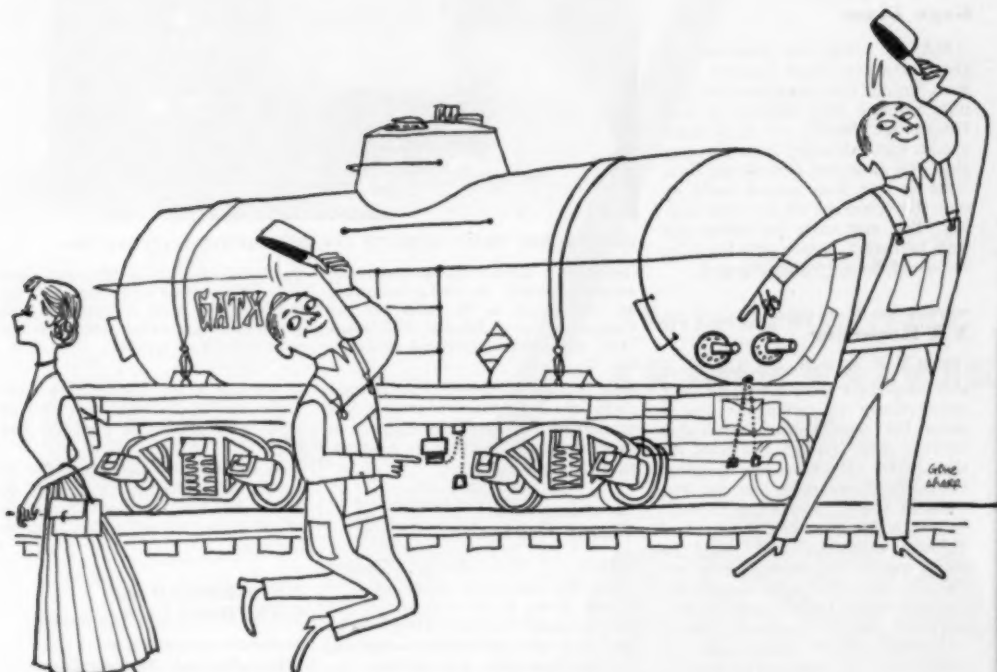
INSTRUMENTATION— GENERAL . . .

USES A VIBRATING WIRE: Measuring Device

(146E) A development program on the Vibrotron, a rugged new high precision measuring device, has been undertaken by the Institute of Inventive Research. The device is designed to provide increased accuracy in measurement and control of such physical quantities as pressure, temperature, velocity, humidity, force, and many others.

The Vibrotron is described as a fine wire vibrating in a magnetic field and generating alternating current of the same frequency as the natural frequency of the wire. Vibration is sustained by a feedback circuit. Any
(Continued)

THE CARE AND NURSING OF TANK CARS



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Be sure that both heater coil
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cap are off. Make certain that
coils don't leak and the
outlet valve operates properly.

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NEW EQUIPMENT, cont. . .

slight change in wire tension from the action of a physical force results in a change in output frequency of the unit, measurable by a simple frequency discriminating circuit.

WITH EXTENDED WINDOW:

Gage Glass

(148A) The new Jerguson gage glass extension, which prevents frost from forming over the vision slot, permits accurate level reading of low-temperature liquids. It is a transparent unit extending from the gage glass and projecting beyond the cover bolts so that frost cannot build up over the vision slot of the cover forging. You may cover the entire gage with insulation, leaving only the outer surface of the extension exposed.

PLOTS GRAPHS AUTOMATICALLY:

X-Y Recorder

(148B) A self-contained, portable strip-chart recorder for plotting automatically on rectangular coordinates the simultaneous relationship between two variables has been designed by Baldwin-Lima-Hamilton Corp. It is necessary that the two variables you are measuring be made to actuate Microformers, the standard Baldwin measuring unit based on strain gages. The impulse from one Microformer actuates the drum rotating mechanism and the impulse from the other operates the recording stylus.

Full-scale 10-in. response of the stylus across the chart can be obtained in approximately 6 sec. and full-scale 10-in. rotation of the chart can be obtained in 20 sec. Dimensions of the instrument are approximately 14 x 10 x 13 in. and it weighs 50 lb.

LIKE A JEWEL IN THE SKY:

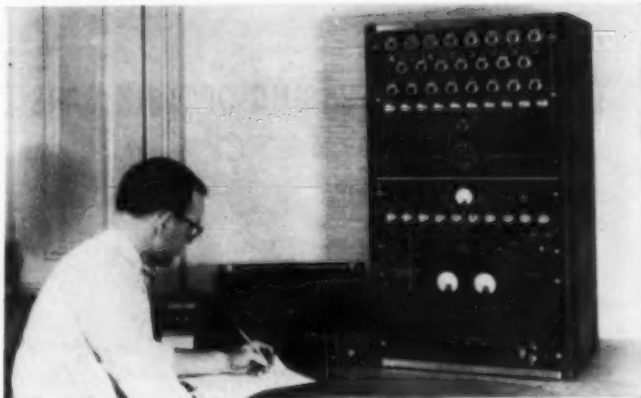
Level Gage

(148C) Yarway flat glass level gages equipped with the new Type M illuminator are said to shine like stars, making the water level in the gage visible over longer distances. Although developed primarily for boilers, applications to process uses should be entirely feasible. Yarway gages are made by Yarnall-Waring Co.

WITH SARAN SCALE:

Manometer

(148D) A new precision absolute and differential manometer designed to cover more than 1 atm. pressure has recently been introduced by the Emil Greiner Co. The manometer



ELECTRONIC BRAIN THRIVES ON DIFFERENTIAL EQUATIONS

(148E) A new electronic brain, more accurately termed an analog computer, has been placed on the market by the Computer Corp. of America. Nicknamed "Ida" (for Integro-Differential Analyser),

the device solves linear differential equations with constant coefficients up to the eighth order. CCA designed Ida with two main considerations—reasonable cost and simplicity of operation.

scale is made of saran. The thermal coefficient of expansion of saran is said to compensate exactly for changes in mercury density due to room temperature variations.

THE ALL-SEEING EYE:

Flame Control

(148F) Combustion Control Corp. has announced a new series of Fireye flame failure safeguards and programming controls. They can be used with all types of flames—gas, oil, or pulverized coal—it is claimed.

The scanner uses a new compact photo-conductive cell which is installed in a short length of $\frac{1}{2}$ -in. pipe located where it can scan the flame area.

The scanner, coupled with the program control, monitors the complete firing cycle from pre-ignition purge through post-fire purge. It checks the pilot and the establishment of the main flame, then stands guard throughout the complete firing period. It is designed to fail safe in case of power failure.

FOR WIDE SPEED RANGES:

Tachometer Indicator

(148G) Metron Instrument Co. now has a three-range, single-head tachometer indicator for use where a particularly wide range of speed measurement is desired. This new instrument, Series 42P, can be used with any Metron tachometer head.

An indicator knob permits selection of any of three speed ranges. Various

tachometer heads cover speeds from $\frac{1}{2}$ rpm. to 100,000 rpm. Scales are all a full 4 in. long, each with 100 divisions.

With ordinary open wires, the indicator can be located up to 1,000 ft. from the head without materially affecting the calibration, according to Metron.

RECORDERS & CONTROLLERS . . .

MEASURES FAST CHANGES:

High-Speed Recorder

(148H) A new electronic high-speed pen recorder for measuring rapidly changing variables has been developed by Minneapolis-Honeywell Regulator Co. Full-scale signals which vary as rapidly as 20 cycles per min. can be recorded on the new instrument. Signals with a peak-to-peak amplitude of 10 percent of scale can be followed even more rapidly—as fast as 3 cycles per sec.

The new instrument is said to be especially suitable for recording and testing of rocket engines where thrust of the engine is measured with strain gages.

FOR ELECTRICAL OR PNEUMATIC SYSTEMS:

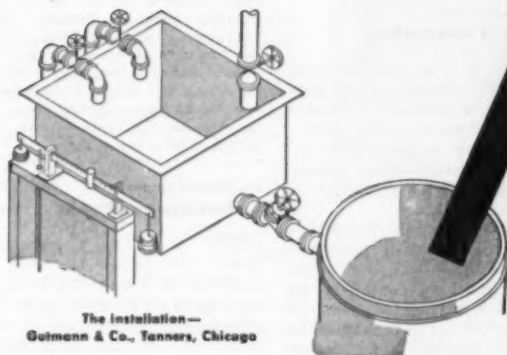
Ratio Controller

(148I) An air-fuel ratio controller announced by Leeds & Northrup rapidly adjusts air flow to changes in fuel flow, without cycling. Applicable to both oil and gas firing, it meters

(Continued)

for outstanding service

on Chrome Tanning Liquor
... for example



The installation—
Gutmann & Co., Tanners, Chicago

PROBLEM: To find a better replacement for valves and cocks used on outlet of open scale tank. Constant trouble with seat leakage, corrosive wear, seizing, and stuffing box maintenance.

WORKING CONDITIONS: Solution handled—highly corrosive basic sulphate of chrome used in tanning of Chrome upper leather. Several batches mixed daily. Gravity flow from scale tank.

SOLUTION TO PROBLEM: Crane No. 1615 Iron Body, packless Diaphragm Valve, Neoprene lined, featuring separate disc and diaphragm design.

RESULT: After more than 2½ years of steady, leak-free service, Crane Diaphragm Valve shows no sign of corrosive or erosive effects... no undue mechanical wear... operates as smoothly as new. Maintenance cost to date—zero.

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NEW EQUIPMENT, CONT . . .

both fuel and air flows for maximum accuracy of control.

Speed and sensitivity are obtained with full stability through the use of an improved control circuit identical with that used in the latest L&N temperature control systems. Wide range of proportional band and reset control actions makes it easy to adjust the control to the needs of the furnace to which it is applied.

Models are supplied to operate electric or pneumatic control valves. When used with electrical control, both the temperature control and the air-fuel ratio control use the same type of plug-in electronic control chassis. When air-actuated control is used, the same type of pneumatic system is built into both the pyrometer and ratio controllers.

The controller comes in a single instrument case which fits standard panel cutouts. Ratio range extends from 50 percent deficiency to 100 percent excess air.



SIDE-BY-SIDE RECORDS:

Multi-Point Recorder

(150A) George Kent Ltd. has developed a multi-point air-operated receiver recorder which provides a synchronized side-by-side record for as many as six variables. This instrument is especially suitable where an electrical instrument would be dangerous because of the presence of flammable gases or liquids.

The instrument receives impulses from pneumatic transmitters located at the points of measurement. It records these impulses on a chart divided into three distinct zones; it can operate on three, four, five, or six points. When it is operating on more than three points and two pens are recording in the same zone, different colored inks are used.

Pen travel is 3 in. for each point.

Each pen is provided with a separate zero adjustment. The system air pressure range is 3 to 15 psi, and the maximum working distance from the transmitters is 1,000 ft.



PREVENTS TAMPERING:

Lock-In Controller

(150B) T a g non-indicating controllers for temperature and pressure can now be provided by Weston Electrical Instrument Corp. with a cover which locks in place. This feature prevents unauthorized persons from making unwanted changes in control point settings.

The control setting mechanism is a spindle with a slotted tip placed entirely behind the locked cover of the case. You adjust the control by unlocking and removing the cover, inserting a screwdriver in the slot of the spindle, and turning in the desired direction. Previously, a knob located on the outside of the case, available to anyone, was used for regulating the instrument.

ELECTRICAL & MECHANICAL . . .

TWO IN ONE:

Part Winding Starter

(150C) Allen-Bradley Co. announces a new a.c. part winding starter for use with motors which employ two separate parallel windings, star or delta, to obtain increment starting. The new starter consists of two across-the-line starters and a pneumatic timing mechanism mounted below one starter and operated by the starter's solenoid plunger.

Pressing the start button immediately closes the first starter, energizing one of the two windings. Meanwhile, the timer is in operation, and after a few seconds energizes the second starter. With both starters closed, full line current is supplied to the motor through both windings, each using 50 percent of the total current drawn.



INTEGRATED LIGHTING SYSTEM

(150D) Character of the Austin Co.'s new integrated ceiling-lighting system is evident in this view during erection of a new Upjohn Co. building. The system employs specially designed trough-like structures of heavy gage sheet steel. Besides serving as structural supports for the ceiling, the troughs become the raceways for fluorescent lighting fixtures. For the Upjohn installation, Austin claims savings of 40 c. per sq. ft.

FOR SMALL-SCALE WORK:

Laboratory Press

(150E) Using a precision hydraulic unit, a new laboratory press made by the Knuth Engineering Co. is designed for pressures up to 83 psi. with a total load of 3,000 lb. It has a standard dial gage to indicate the number of pounds of direct hydraulic pressure.

This new unit is already in use in a number of laboratories, it is said. One state university is using it for extracting vitamin D from insects. Other units are being used for crushing stones and extracting liquor from pulp.

HYDRAULIC SHOCK ABSORPTION:

Damping Valve

(150F) A new surge damping valve for eliminating excessive shock in high-pressure hydraulic systems has been developed by Denison Engineering Co. Small and compact, it is installed as easily as an ordinary fitting.

The valve adjusts itself automatically to any working pressure, requires only a fraction of a second to act, and does not slow down cycle time, says Denison. It prevents damaging vibrations caused by sudden starting or reversing of flow.

Normally closed, it gradually opens when pressure is applied to the inlet side. When the flow is interrupted the valve quickly resets and is ready for

(Continued)

Why OLIVER chooses

Lightnin Mixers

for Kelly
Sulphur Filter Units



There's a reason why Oliver United Filters Inc., include a Lightnin Mixer as standard equipment on the well-known Kelly Pressure Filter unit, used today in sulphuric acid plants throughout this country and abroad.

The Lightnin Mixer suspends filter aid uniformly in hot molten sulphur—helping to insure a clean, firm precoat on the filter leaves, and easy discharge of the filter cake. It is also excellent for preparing filter aid and precoat slurries for general use.

Mounted off-center in the precoat mix tank, this Lightnin Mixer gives complete turnover and intimate mixing of the tank contents, quickly and without need for special baffling. The mixer needs lubrication only once a year.

Just one more good example of Lightnin performance and adaptability in meeting special needs. If you're looking for top results with a process that involves solids suspension, mixing, blending, heat exchange, emulsifying, gas absorption, crystal size control, washing, circulating—or any other fluid agitation need—consult us. Write briefly, describing your problem—or check and mail the coupon for descriptive material on Lightnin Mixers and Mixco engineering services.

LIGHTNIN Case History

Operation: Pressure filtration of molten sulphur, to remove impurities and increase sulphuric acid yields.

Equipment: Kelly Pressure Filter (#50 Sulphur Package Unit), manufactured by Oliver United Filters Inc.

Mixer Application: Suspend filter aid (0.5% by weight) in molten sulphur at 280° - 290° F., for precoating filter leaves.

Mixer: Lightnin Model LDG, 3 HP. gear drive, dual propeller, off-center mounted.

Mixer Performance: MOST SATISFACTORY. Manufacturer is well pleased with results.

MANUFACTURERS OF

Lightnin Mixers



LIGHTNIN
PORTABLE
MIXERS

World's longest-running line. Blends or air mixes, 4000 or 2000 cubic ft. to 2 HP.



LIGHTNIN
SIDE ENTERING
MIXERS

For tanks up to 5 million gallons. Gear motor or V-belt drive, motorless types. Sizes 1 to 25 HP.



LIGHTNIN
TOP ENTERING
AGITATORS

Turbine, propeller and paddle types. For open or closed tanks. Sizes 1/2 to 200 HP.

MIXING EQUIPMENT Co., Inc.

(MIXCO)

128 Mt. Read Blvd., Rochester 11, N. Y.

In Canada: William & J. G. Gray, Ltd., Toronto

Please send me the literature checked:

- | | |
|---|---|
| <input type="checkbox"/> B-76 Side Entering Mixers | <input type="checkbox"/> DH-50 Laboratory Mixers |
| <input type="checkbox"/> B-78 Top Entering Mixers (Propeller Type) | <input type="checkbox"/> B-36 Condensed Catalog showing complete line |
| <input type="checkbox"/> B-89 Top Entering Mixers (Turbine and Paddle Type) | <input type="checkbox"/> B-75 Portable Mixers (Electric and Air Driven) |

Name

Title

Company

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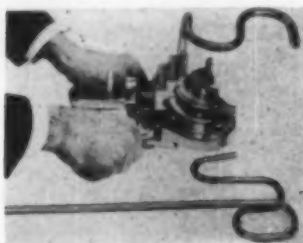
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A COMPLETE LINE :: UNEXCELLED TECHNOLOGY

NEW EQUIPMENT, CONT. . .

the next operation. It requires no manual adjustments and has no external drain.

An unusual feature is that this valve will open at a slower rate of speed at high pressures than at low pressures, when the valve is subjected to sudden surges of fluid.



HANDLES THREE SIZES:
Tube Bender

(152A) Engineers and technicians will find this new tube bender useful in setting up experimental or production units. Made by Tal Bender, Inc., this one tool can handle $\frac{1}{4}$ -in., $\frac{1}{2}$ -in., and $\frac{3}{4}$ -in. O.D. sizes in copper, brass, steel, and other light-gage tubing. No vise or fixtures required.

FOR LARGE VOLUMES:
Air Cleaners

(152B) Sela Liqui-jectors are now available in large sizes for continuously and automatically removing entrained water, oil, and dirt from large volumes of compressed air or other gases. Formerly limited to sizes up to 75 cfm., Series B Liqui-jectors can now be obtained for 100, 250, and 500 cfm. of free air.

The largest size uses 24-in. I.P.S. air connections with a 1-in. liquid drain. They are all good for 150 psi. maximum inlet pressure. They use liquid-impervious porous filters, with no moving parts.

DISREGARDS LOAD VARIATIONS:
Speed Control

(152C) Industrial Control Co. has come out with a speed control whose purpose is to maintain motor speed approximately constant, regardless of variations in load demand torque. It consists of a special motor and a companion control box operating from a 115-v., 60-cycle source.

The combination provides fingertip control of motor speed from 50 to 5,000 rpm. A front panel meter, calibrated in rpm., gives the motor speed

directly. The motor will deliver up to 10 in.-oz. of torque at any speed within the given range.

NEW INTERRUPTING PRINCIPLE:
Motor Starter

(152D) An a.c. motor starter just introduced by Clark Controller Co., the CY-2, makes use of a new arc interrupting principle. This feature combines the use of strong multi-turn magnetic blowouts with twin break contacts.

The arc is extinguished by applying the effect of the blowout coil concentric with the contact. The action of the blowouts assures that any arcing will occur uniformly over the entire contact surfaces, thus minimizing burning and pitting of contacts.

No carbonizing of insulating material can occur because all parts in the arc chamber are copper, brass or steel. The absence of carbon and soot means longer contact life and lower operating temperatures.

USES AN ALL-METAL SEAT:
Expansion Joint

(152E) Phillips Rotary Joint & Valve Co. is making a new 180-deg. rotary flexible expansion joint in 14-in. to 12-in. sizes. It can be used for steam, water, oil, chemicals, and gas. This joint is of the packless type, with an all-metal seat or seal which is said to be leakproof.

Flexibility is accomplished by a rotating member which is carried in two inserts lapped together to insure a good seal. This combination allows the rotating member to flex while the unit expands, thus relieving stresses.



MOBILE POWER PLANTS RIVAL SUBMARINES IN COMPACTNESS

(152F) Eleven 600-kw. mobile power plants, originally built for Russia under lend-lease but never delivered, are being converted to American specifications by the Navy's Bureau of Yards and Docks for emergency use in the U. S. Housed in a specially built railroad car, each plant

FLUID FLOW . . .

JACK-OF-ALL-TRADES:
Centrifugal Pump

(152G) A new single-stage open impeller Goulds centrifugal pump, known as Fig. 3169, has recently been announced. Designed for economy, dependability, and versatility, it is said to be adaptable to a wide variety of applications, such as air conditioning, plumbing, irrigation, slurries, wastes, etc.

The new pump is available in ten sizes for both motor and belt drives. Upper capacity limit is 1,080 gpm., with heads up to 290 ft., depending upon capacity.

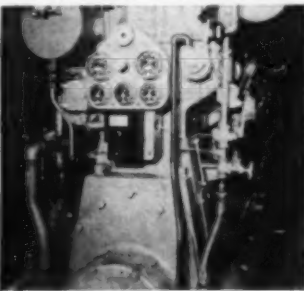
INSTALLED UPSIDE DOWN:
U-Tile Conduit

(152H) Porter-Hayden Cos. are offering a new tile conduit for underground pipe installations. This conduit is designed for use with a single pipe or several small pipes. The tile encloses the pipes by inverting the U and bonding the flat or open end to the concrete base supporting the pipes.

U-Tiles are shipped to the job site as flattened cylinders, scored longitudinally on both of the flattened sides. By tapping over each scoring with a hammer, you can split each cylinder into two U-Tiles.

NO INTERNAL OBSTRUCTIONS:
Gate Valve

(152I) Made especially for use with large pipelines, the new Walworth Type 49 steel gate valve is designed on the through-port principle. (Continued)

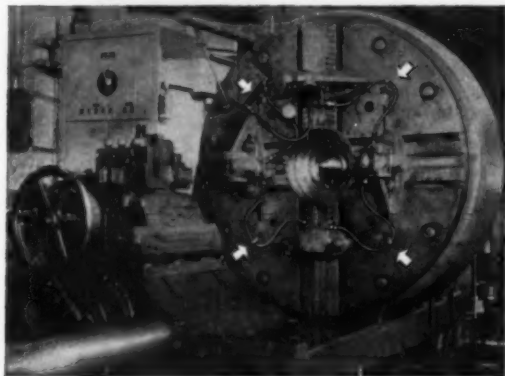


Hints for making your products "flexible"

Here are three widely diverse and totally unrelated products. Yet each is made more useful, more versatile with the help of American Flexible Metal Hose or Seamless Tubing.

For piping or ports that move, vibrate or are out of alignment; for carrying almost any liquid, gas or semisolid under high temperatures or pressures, there's a type of

American Flexible Metal Hose or Seamless Tubing for the job. You'll be interested in Bulletins SS-50 and CC-300 with technical details and many application histories. Send for them today. The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd. 01228



LATHE CHUCK

This giant lathe chuck holds railroad car wheels. To exert equal pressure on the wheel rim, five sets of American Seamless Bronze Flexible Tubing carry hydraulic fluid to each of the five driving dogs. This is a typical example of the combined strength, tightness and flexibility which characterize American Flexible Metal Hose and Tubing. Photo courtesy Wm. Sellers & Company Division, Consolidated Machine Tool Corporation, Rochester, N. Y.

EYE EXTENDER

Here's a handy gadget for oil burner and air conditioning installers and repair men—an inspection mirror on a flexible arm utilizing American $\frac{7}{12}$ " Flexible Steel Tubing. Adjusts to any position of the familiar "gooseneck" lamp arm, for which millions of feet of this American Lamp Arm Tubing have been used. Photo courtesy Eddington Metal Specialty Company, Eddington, Pa.

OIL CONVEYOR

Here's a rough, tough job for American Flexible Metal Hose—transferring heavy road oil from tank truck to sprinkler. Naturally, this service calls for dependable performance under conditions of abrasion, abuse, corrosion, chemical attack and exposure to elements.



wherever connectors must move . . .

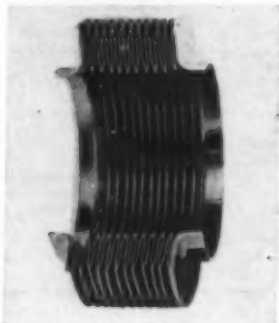
American FLEXIBLE METAL HOSE AND TUBING



NEW EQUIPMENT, cont.

with body and disk ports accurately indexed and body ports bored to match connecting piping. This valve has no recesses to accumulate dirt and no obstructions to interfere with the free flow of liquid or passage of scrapers.

Walworth makes Type 49 in sizes up to 30 in. in Series 400 and 600. Valves have Stellite seat rings and the body-to-bonnet joint incorporates a boltless design. The valves do not require any internal lubrication, says Walworth, and may be installed without regard to flow direction.



OF WELDED CONSTRUCTION:
Expansion Bellows

(154A) Manufacture of bellows for absorption of vibration and lineal expansion has been undertaken by Titeflex, Inc. These bellows are constructed of convoluted metal diaphragms welded into complete units. Height of the convolutions varies according to the degree of flexibility required; wall thicknesses are specified for the particular pressure requirements.

Titeflex can supply the new bellows in sizes from 1 in. to 5 in. I.D. in various lengths. They are made of steel, stainless steel, brass, bronze, Monel, or Inconel. They are supplied with or without sleeve liners.

EMPLOYS AIR COOLING: **Compressor Cylinder**

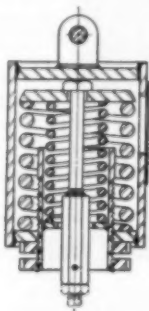
(154B) Development of a new air-cooled, high clearance, low valve velocity compressor cylinder by Clark Bros. has resulted in increased capacity and improved performance for gas transmission pipelines. It is said to increase the capacity obtainable per horsepower while reducing water piping and cooling system costs.

This cylinder was specifically in-

tended to accommodate a wide range of suction and/or discharge pressures and capacities. To accomplish this, the cylinder was designed for a wide range of built-in clearance (30 to 70 percent) obtained by using specially designed pistons.

Fins along the cylinder serve the dual purpose of removing heat from the ring band area and providing a uniform cylinder temperature. The use of air cooling leaves the cylinder walls sufficiently warm to make condensate collection within the cylinder a negligible consideration.

Elimination of water jacketing has permitted an increase in the size of the air passages, thus lessening the pressure drop due to friction. The omission of water passages in the cores makes these cylinders easier to cast; as a result they have been designed for higher working pressures.



ELIMINATES RESONANT VIBRATIONS:
Pipe Hanger

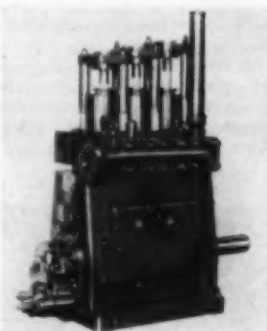
(154C) Bergen Genspring Corp. has developed a non-resonant variable-support pipe hanger, designed to eliminate resonant vibrations at all frequencies. Regardless of the impressed frequency, a resonant amplitude cannot develop in this new hanger, it is claimed, thereby protecting the piping system under all operating conditions.

The NR hanger owes its non-resonant characteristics to the use of two helical springs in parallel arrangement. The outer, or load spring, supports the entire weight of the pipe at all times. The inner, or snubber spring, functions only when vibration occurs.

When the line first reaches operating temperature the snubber spring is brought into position by a simple external adjustment. Normally, without vibration, the snubber is unloaded. With the slightest vibration, however, it is loaded intermittently, thereby changing the stiffness of the hanger with each half cycle of vibration and

preventing the development of a resonant amplitude.

A wide range of sizes is available.



FEATURES STRAIGHT-LINE FLOW:
Triplex Pump

(154D) Aldrich Pump Co. has added to its line of direct-flow triplex pumps one with a 3-in. stroke. This pump can operate at speeds up to 500 rpm. and discharge pressures up to 3,800 psi. Maximum displacement at 790 psi. is 96 gpm.

The direct-flow pump is so named because it provides a straight liquid path through the working barrel. This feature eliminates two right-angle turns in the fluid-end block, improving volumetric efficiency.

Changes in plunger size can be readily made to provide alterations in pressure or capacity.

MATERIALS OF CONSTRUCTION . . .

NON-CORROSIVE, SANITARY: **Plastic Pumps**

(154E) Flex-i-liner squeegee pumps, sold by Vanton Pump Corp., are now available with polyethylene body blocks and vinyl liners. They can be used for handling acids, alkalis, and other chemicals to which these plastic materials are resistant.

At present, pumps are available in capacities up to 5 gpm. Terminals are either drilled and tapped with 1/4-in. or 1/2-in. pipe thread or supplied with saran tubing fittings or hose connections. A 1/2-hp. motor is required.

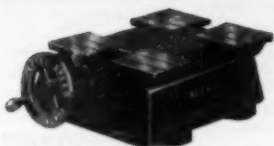
HOW TO CROW OLD FAST: **Rubber Tester**

(154F) For accelerated aging and weathering tests of rubber and rubber-like materials, G. F. Bush Associates offers a new Ozonator. This device generates, maintains, and meas-

(Continued)

Reeves Vari-Speed Motor Pulley

converts any standard constant speed motor
to a low-cost stepless variable speed drive . . .



1. REEVES Motor Base provides sliding platform for motor. Handwheel or push-button control increases transmitted speed by moving motor toward driven machine, decreases speed by reversing the operation.

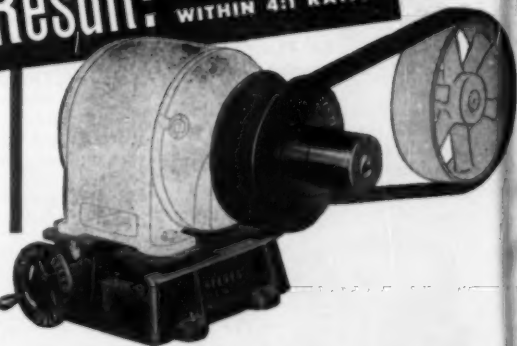


2. Disc Assembly connects directly to motor shaft. Assembly consists of two facing cone-shaped discs—one sliding laterally—and compression spring for mounting as a single unit on motor extension shaft.



3. Special V-Belt hooks up unit with driven machine. Belt fits between discs and over pulley on power input shaft of driven machine. Belt is adjusted to minimum center.

Result: INFINITELY
VARIABLE SPEED
WITHIN 4:1 RATIO



Unit instantly delivers any desired speed over entire range and maintains that speed without fluctuating even a fraction of an rpm.

The REEVES Vari-Speed Motor Pulley is the easiest, lowest-cost method of converting a machine with fixed speeds into a highly versatile unit of infinitely variable speed adjustability. Thus equipped, it can handle a wider range of work, better, faster and more economically, because machine speed can be changed instantly and accurately—without shutdowns—to meet the needs of every operation and every operator, *under every changing condition.*

This REEVES unit forms the actual driving element between motor and driven shaft . . . eliminates all auxiliary equipment such as chain drives, gears, belts, etc. . . . requires virtually no more space for installation than any standard belt or chain drive. It is built in eleven sizes, transmitting from $\frac{1}{4}$ to 10 hp, over speed ratios from 2 $\frac{1}{4}$:1 to 4:1, inclusive.

The complete line of REEVES Speed Control equipment also includes two other basic units, the Variable Speed Transmission and the Vari-Speed Monodrive, which are offered in the

widest selection of designs, sizes, capacities and speed ratios—handwheel, push-button or entirely automatic controls.

REEVES units have proved their ability to speed production, cut cost and increase profit in more than 300,000 widely diversified industrial applications . . . are listed as standard equipment on over 2,100 different makes of modern machines.

An experienced REEVES Speed Control specialist will be glad to work with you in selecting the units best suited to your needs. Write today, arranging an interview, and ask for Catalog CE7b-G.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE
Reeves Speed Control
GIVES THE RIGHT SPEED FOR EVERY JOB

NEW EQUIPMENT, cont. . .

ures a continuous flow of ozone, under controlled conditions of pressure, temperature, and flow rate, through a specimen exposure chamber. It meets ASTM test requirements.

The new Ozonator features the uniform distribution of temperature and ozone throughout the test space; a continuously operating thermal flowmeter; accurate voltage control of the ozone generator. Air flow and generator voltage are indicated by two conveniently mounted meters.

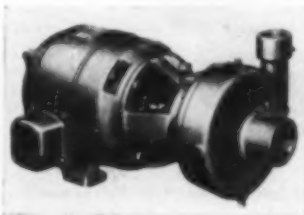
The exposure chamber provides 6 cu. ft. of space. Power requirement is 85 w. of 115-v., single phase current.

LIGHT AND STRONG:

Building Block

(156A) American Nayco Corp. is introducing in this country a building block developed in Sweden. Known as Ytong, this material is said to be light, cheap, strong, fireproof, and moisture-resistant. Its porous structure provides good heat insulation, yet compressive strength is 1,000 psi. It can be cut and sawed like wood.

Raw materials for Ytong are low-quality oil shale, limestone, and coal mine waste. It can be produced in 20x10-in. blocks 2 to 14 in. thick. Territorial manufacturing rights are being offered to qualified American companies.



AVAILABLE FROM STOCK:

Stainless Pumps

(156B) Bell & Gossett Co. is offering small centrifugal pumps with all wetted parts made of Type 316 stainless steel. These pumps are carried in stock and are available for prompt delivery, according to B&G.

The new pumps are built in discharge sizes of $\frac{1}{4}$ to $\frac{1}{2}$ in.; horsepower run from $\frac{1}{4}$ to 2. They are provided with Teflon mechanical seals, hydraulically balanced impellers, spring-type flexible couplings, and standard motors. You can service these pumps easily—removal of a few bolts permits separation into three parts.

PROMISING FABRICATION POSSIBILITIES:

Brazing Alloy

(156C) Wall Colmonoy Corp. has developed a new brazing alloy, trade-named Microbraz. This alloy, it is said, opens up many new and important possibilities in assemblies and fabrications involving stainless steels, high nickel alloys, and the new superalloys widely used in jet engine and gas turbine construction. It is supplied as a powder, and when molten flows and penetrates the joint readily.

Many parts made from stainless steel, where corrosion resistance is the primary factor, have customarily been machined from the solid or mechanically fabricated. Using Microbraz to braze such assemblies together would, in many instances, produce a better part at less cost, it is claimed.

To date, applications of the new material have been primarily in jet aircraft and other fields where the completed assembly operates at temperatures of 1,200 to 1,800 deg. F. However, its corrosion-resistant properties indicate wide possibilities for it in chemical, petroleum, and food processing.

Microbraz contains an appreciable amount of boron in addition to 65-75 percent nickel and 13-20 percent chromium. The company states that it has been successfully employed in brazing stainless steels, carbon steels, alloy and tool steels, Inconel, Monel, titanium, and metal carbides. When brazing stainless steels, a stable new alloy appears to be formed from fusion and alloying with the parent metal.

WITH STAINLESS STEEL CASE:

All-Purpose Thermometer

(156D) Featuring a stainless steel case, a new all-purpose thermometer, Tag Model 8689, can be had from Weston Electrical Instrument Corp. Welded throughout, rather than soldered, the stainless case is claimed to be the strongest of its type available, capable of outlasting any other material used for similar purposes.

Another feature is a removable scale and tube unit for easy replacement if you should happen to break the tube. This arrangement also permits easy interchange of five different scales, ranging from -40 to +400 deg. F., with the use of only one case.

WILL HOLD SUSTAINED VACUUM:

Teflon-Metal Seal

(156E) United States Gasket Co. has recently succeeded in sealing Teflon to several different metals. The

result is a true hermetic seal, said to be capable of holding a vacuum for sustained periods.

The new seal is recommended where severe service conditions are encountered. It will withstand vibration, wide temperature limits, and mechanical and thermal shock. Preliminary evaluation shows that the structure is microcrystalline in nature—the seal gradually changes from a pure resin to a pure metal.

The company offers to design various types of terminals, printed circuits, or metal-faced Teflon sheets, rods, or cylinders for particular problems.

COMPOSITION MEASUREMENT . . .

MEASURES LIGHT INTENSITIES: Microphotometer

(156F) A new photomultiplier microphotometer for the precise measurement and comparison of light intensities has been announced by American Instrument Co. It can be used for the measurement of turbidity, reflectivity, color, and luminescence. Full-scale deflections of the meter are given with phototube currents of 10, 1, 0.1 and 0.01 microamp. The meter indicates percent transmission, density, and current directly without correction factors.



HOW DRY I AM:

Humidity Indicator

(156G) A new humidity indicator, called the Humigraph, consists of a card measuring $6\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. with a vertical column of seven color spots denoting relative humidity from 10 percent to 70 percent. Available from Andrew Technical Service, the device is usable at temperatures of from 50 to 200 deg. F.

This indicator can be inserted in packages of materials affected by

(Continued)

"PASSED THE ACID TEST" ...SURPASSED ALL ENDURANCE RECORDS"

QUAKER ACID SUCTION HOSE

PROVED BEST BY SERVICE AT CALCO CHEMICAL

Carrying sulfuric acid 24 hours a day ... dragged over rough brick flooring from one vat to another. That's how Quaker Acid Suction Hose is at work in the plant of Calco Chemical Division, American Cyanamid Company, Gloucester, N. J. ... defying abrasion, twisting and constant exposure to acid.

Quaker Acid Suction Hose is only one of the many different kinds of hose Quaker has developed especially for the Chemical Industry. Each is different in design and engineered for the various requirements of pressure, strength, flexibility and punishment to be encountered on the job.

To get the best hose for your plant—whether it's for conveying acids, agitating solutions, pneumatic equipment, flushing and cleaning work, or fire service—consult your Quaker representative. For data on Quaker's complete line of hose, belting, and packing, write for the new Quaker General Catalog—#751-CE.

FOR MORE PRODUCTION ... GET THIS BOOK
and other data of the QUAKER Conservation
Maintenance Plan. Helps you reduce maintenance
... increase production ... save rubber. No
charge, no obligation. Ask for "CMP."



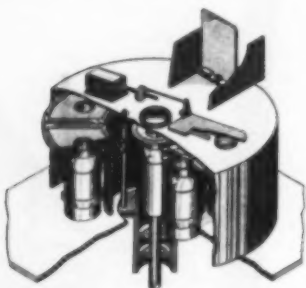
QUAKER RUBBER CORPORATION

DIVISION OF H. K. PORTER COMPANY, INC.

PHILADELPHIA 24, PENNA. BRANCHES IN PRINCIPAL CITIES



humidity changes, or for spot checking of humidity without recourse to instruments or charts. Changes of humidity cause the spots to turn color. The reading is made at the top blue spot.



MEASURE DIRECTION, TOO:

Dirt-Fall Collector

(158A) A new instrument to help analyze air pollution problems has been developed by Battelle Institute and will be made commercially available by Eberbach & Son Co. Because it will tell the direction from which the polluting dirt comes, Battelle expects the new device to become useful to industries and municipalities in locating the sources of air pollution.

The instrument consists of a series of eight jars arranged in a circle with a ninth jar in the center. These jars have metal funnels which will collect the dirt not falling directly into the jar mouth. At the end of the collection period, the dirt may be brushed into the appropriate jar.

The jars are covered by a canopy which has one hole at the outside edge and another at the center. A system of vanes and electrical contacts turns the canopy and opens the proper hole for collecting the dirt in the jar corresponding to one of the eight points of the compass.

For a reliable indication of the sources of contamination the instrument must be exposed for 30-day collection periods over many months in a carefully chosen location representative of a given area. The amounts of collected material must be correlated with data obtained from the weather bureau.

FOR PORCELAIN ENAMELS AND CERAMICS:

Color Standards

(158B) A new set of color standards for porcelain enamels and ceramics has been made available by



ANALYZES METAL SAMPLES

(158C) The Griswold OPL Metallograph facilitates rapid structural analysis of samples of metals and other substances. You can view the sample through binoculars or on a ground glass screen; you may take photographs on 35 mm. roll film by merely swinging the image from the ground glass to the camera.

the Henry A. Gardner Laboratory. The new set consists of 15 colors—four red, four yellow, three green, and four blue plaques.

To obtain the best separation of colors within the color solid, one panel of each hue is the strongest color available, one is a light tint, one is grayed and of medium lightness, and one is dark. There are only three greens because of the limited chroma range available in ceramic greens.

PROCESSING . . .

FOR LABORATORY TESTING:

Ozonator

(158D) A new laboratory ozonator, Model T-23, has been announced by the Welsbach Corp. This

new model provides a convenient source of ozone for testing its potential value as an oxidizing agent in various chemical processes.

Ozone is of special interest as a means of destroying or reducing tastes, odors, and colors in waste treatment and water purification, especially where phenol and cyanides are involved.

SMALL VOLUME, HIGH PRESSURE:

Filter Unit

(158F) Sethco has announced a new filter unit, Model LGI-5, designed for filtering oils, glycerine, and other organic lubricating liquids in applications requiring the pumping of small volumes at high pressures. This unit is equipped with a compact, positive pressure, self-priming gear pump made with an aluminum body and hardened steel gears.

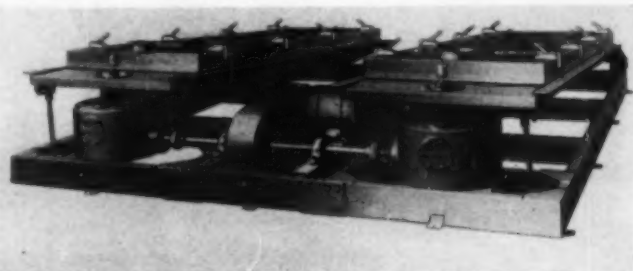
The filter cylinder is made of Lucite with stainless steel fittings. Filter tubes consist of specially processed cotton yarn wound around a stainless steel supporting core. Porous stone and porous carbon tubes are furnished for special applications. The density of all filter tubes is such that even the finest particles are removed, says Sethco, resulting in crystal clear filtration.

WHERE PROPELLERS ARE INEFFECTIVE:

Mixing Device

(158G) A new mixing device, the Simplex Dispensator, is now being manufactured by the Premier Mill Corp. It is designed for processing operations where propellers are generally ineffective.

The Dispensator is a slotted cylinder which rotates at high speed. Centrifugation (Continued)

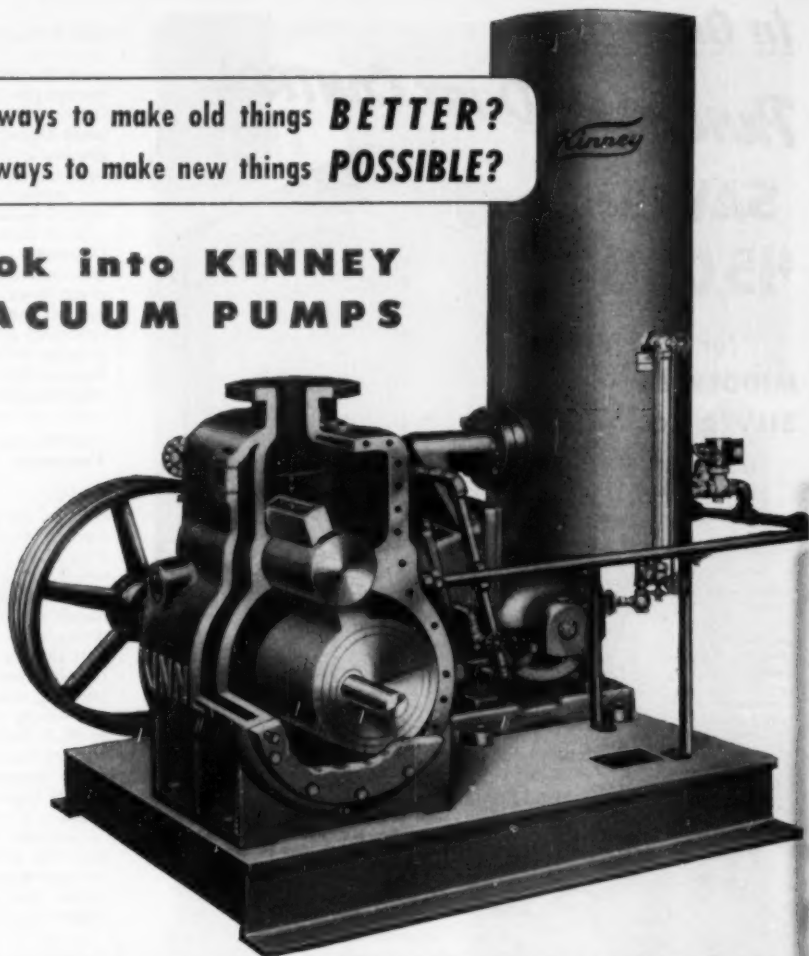


TANDEM MOUNTING REDUCES SCREEN VIBRATIONS

(158E) Patterson Foundry & Machine Co. is now making tandem-mounted Gyro-centric screen units. This design, comprising two screens compactly assembled on a common support frame and driven by a single motor, is claimed to eliminate virtually all vibration. This is achieved by moving the screens in opposing directions so that the unit as a whole does not feel the motion.

Looking for ways to make old things **BETTER?**
Looking for ways to make new things **POSSIBLE?**

Look into KINNEY VACUUM PUMPS



More vacuum processes depend on this "vacuum powerhouse" than on any other type or make of pump. More new developments — new products, new improvements in old products — are made possible and practical by this pump. Every day, more and more engineers use this pump to make their vacuum dreams come true — in the laboratory, the pilot plant, the production line.

Have you looked into Kinney Vacuum Pumps? Do it today — just fill out and mail the coupon. KINNEY

MANUFACTURING CO., Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle.

FOREIGN REPRESENTATIVES: General Engineering Co. (Radcliffe) Ltd., Station Works, Bury Road, Radcliffe, Lancashire, England • Horrocks, Rosburgh Pty., Ltd., Melbourne, C. I. Australia • W. S. Thomas & Taylor Pty., Ltd., Johannesburg, Union of South Africa • Novelectric, Ltd., Zurich, Switzerland • C.I.R.E., Piazza Cavour 25, Rome, Italy.



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3551 WASHINGTON ST., BOSTON 30, MASS.

Gentlemen:

Please send illustrated Bulletin V45. We are interested in:

- ☐ Vacuum exhausting ☐ Vacuum distillation
☐ Vacuum coating ☐ Vacuum metallurgy
☐ Vacuum dehydration

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Company _____

Address _____

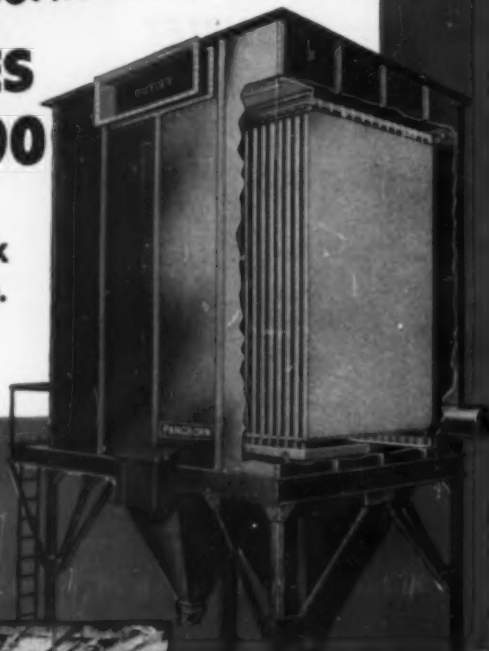
City _____ State _____

In One Year **PANGBORN DUST CONTROL**

SAVES
\$15,000

for
MIDDLESEX
SILVER CO.

(division of
R. Wallace
& Sons Co.)



Shown below is the
loading and unloading
operation at Middlesex.
Note the hand and
pallet system
which conveys
material up to
the Collector mounted
station.



Heart of profitable dust control at Middlesex Silver is a Pangborn CJ Collector like this. Shown above in a cutaway view are the filters which make the CJ ideal for heavy loading applications like this.

cloth screen Collector. Result to Middlesex: Pangborn Dust Control has more than paid for itself since installed!

Pangborn Dust Control recovers valuable silver from plant dust!

Talk about profit! Every year Pangborn Dust Control at Middlesex Silver earns a profit of \$15,000 after all operating expenses are paid! Centrifugal collectors are used to trap coarse dust particles . . . and **high efficiency is assured** because valuable silver fines are recovered by the big Pangborn CJ

Pangborn has a complete line of Dust Collectors, each designed for a specific job. No matter if the dust in your plant is **valuable, hazardous, or just a nuisance . . .** chances are Pangborn Dust Control will **save you money**. Find out . . . there's no obligation. For full information, write today for Bulletin 909A to PANGBORN CORPORATION, 2600 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the Latest Developments in Dust Control and Blast Cleaning Equipment

Pangborn

DUST CONTROL

STOPS THE DUST HOG from stealing profits

NEW EQUIPMENT, cont. . .

gal action forces the materials outward through the slots at high velocity. Shearing action occurs as the material passes through the narrow slots and also as the high velocity streams of liquid emerging from the slots come into contact with the slower moving mass of liquid in the vessel.

Tests have demonstrated that the Dispersator achieves satisfactory results in such operations as building up of emulsions and dispersions, acceleration of chemical reactions, and prevention of settling. It can be used to promote turbulence and contact between a liquid and another liquid, a solid, or a gas.

COMPLETE WITH CONTROLS: Vacuum System

(160A) A new vacuum system designed for a wide variety of uses in research, control, and production has been developed by RCA. This unit, designated as Type EMV-5, serves such applications as evaporation of metals and salts, vacuum distillation, drying, and vacuum coating.

It consists essentially of a vacuum chamber and a high-speed vacuum pumping unit. The pumping system and valving are similar to those used in RCA electron microscopes. A mechanical fore pump and an oil diffusion pump evacuate the chamber to 0.1 micron Hg in less than 7 min., says RCA.

The new equipment features conveniently grouped controls and accurate meters, all mounted on the front panel. The unit is housed in a steel cabinet finished in two-tone gray.



FLEXIBLE AND VERSATILE: Multi-Speed Mixer

(160B) Up to 16 agitation speeds are obtainable with a new heavy-duty Lightnin mixer developed by Mixing Equipment Co. Speed is changed merely by removing a cover

plate and replacing two gears with a different pair, supplied by the manufacturer. The change from one operating speed to another is made in a few minutes, it is claimed, without dismantling the unit or removing it from the tank, and in most cases without even disconnecting the motor. Standard output speeds range from 16.5 to 420 rpm. Sizes are from 1 to 500 hp.

Other operating features of the new mixers include: Independent shaft suspension, to protect the gearing from shaft flex and permit use of different shafts without changing the gearing; interchangeable mounting brackets, which simplify adaptation from open tank to closed tank use; and standard interchangeable impeller construction, with a wide choice of impeller shapes and sizes.



**FITS ANY FACE:
Plastig Goggle**

(161A) The Methaspec Eye-Saver is a recent development of the Watchmoke Optical Co. It is made of Plexiglas only 1/10-in. thick and weighs only 1 1/4 oz.

Temples of the new goggle can be lengthened or shortened to suit various individuals. The lens angle may also be adjusted to provide the best fit. In addition, the bridge of the Methaspec is thick on one side, thin on the other, and may be reversed so that either side touches the wearer's nose.

**DOES IT WITHOUT MIRRORS:
Industrial Television**

(161B) The Ultiscope, a wired television set, transmits an exact, instantaneous, and continuous picture from a remote operation to a viewing screen placed in a conveniently located control panel. This arrangement permits visual control of operations which may be too dangerous, difficult, or inaccessible to watch directly. Made by the Diamond Power Specialty Corp., the Ultiscope uses a coaxial cable instead of broadcast.

Babcock & Wilcox is using a set in the continuous casting of steel billets, a very critical operation. The

(Continued)

**Here's
BIG
NEWS**

**Blast Cleaning
Dust Control
Precision Finishing**

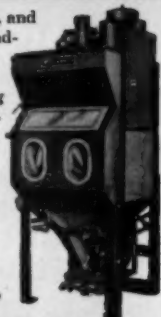
**Blast Cleaning Unit
is PORTABLE!**

**Hydro-Finish
SPEEDS POLISHING!**



Ideal for maintenance and many other jobs, including removal of rust, dirt, scale, etc. Economically cleans large objects like tanks, bridges, structural work before painting. Six sizes, stationary or portable, from \$170.00 and up

Removes scale, and directional grinding lines . . . prepares surfaces for plating and holds tolerances to .0001"! Liquid blast reduces costly hand cleaning and finishing of molds, dies, tools, etc. Models from \$1295.00 and up



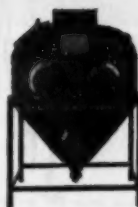
**STOP DUST
at the SOURCE!**

**COMPACT Blast Cabinet
for SMALL WORK!**



Pangborn industrial type Unit Dust Collectors trap dust at source. Machine wear is minimized, housekeeping and maintenance costs reduced. Solves many grinding and polishing nuisances and material losses. Models from \$286.00 and up

Ideal for producing smooth, clean surfaces on pieces up to 60" x 36" in size. Cleans metal parts, removes rust, scale, grime, dirt, paint, etc., in a few seconds. Saves money all year 'round. Models from \$315.00 up



Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment

Pangborn

**MAIL
COUPON
FOR DETAILS**

Check for more
information

- ☐ Blast Cleaning Cabinets
- ☐ Blast Cleaning Machines
- ☐ Unit Dust Collectors
- ☐ Hydro-Finish Cabinets

PANGBORN CORP., 2600 Pangborn Blvd., Hagerstown, Md.
Gentlemen: Please send me more information on the equipment I've checked at the left.

Name

Company

Address

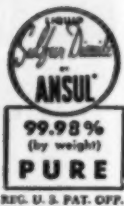
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of trained and experienced
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If you have a problem or
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Engineers can be of service
to you.

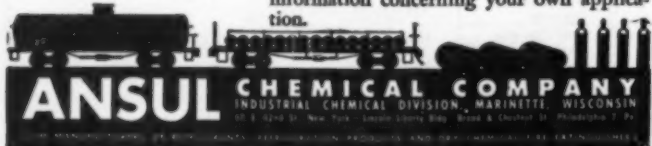
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To compliment the availability of liquid
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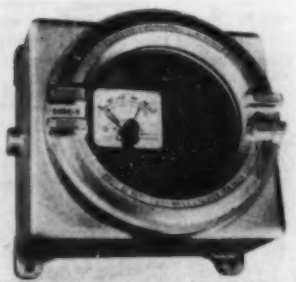
Write for File No. 300 and ask for specific
information concerning your own applica-
tion.



NEW EQUIPMENT, cont. . .

camera is suspended above the mold. A single operator, 50 ft. away and out of heat and danger, watches the process on the viewing screen and closely controls the pouring operation.

Formerly, an extra man stationed directly at the mold top watched the pouring and signaled the operator. Besides the hazard and discomfort to this man, there was always the possibility that the signals would be mis-understood.



FOR HAZARDOUS LOCATIONS: Explosion-Proof Controls

(162A) Simplytrol automatic controls, made by Assembly Products, Inc., can be provided with explosion-proof housings for use in hazardous locations. The instrument shown is a double-contact, thermocouple pyrom-eter with a temperature range of 0 to 1,000 deg. F. Similar instruments are available for control of speed, thick-ness, and overload.

EXPANDED EIGHT TIMES: Sweat Band

(162B) A new cotton sweat band is produced by General Scientific Equipment Co. by a special process from cotton-backed gauze expanded to about eight times its normal thick-ness. The result is a product which is highly absorbent, soft, and light. When worn by workers engaged in hot operations, these sweat bands will help keep spectacles and goggles clear, increasing efficiency and safety.

They cost about 3-4c. each, depend-
ing on the quantity ordered.

CARRY IN YOUR HIP POCKET: Geiger Counter

(162C) Precision Radiation In-struments has come out with a small, light-weight Geiger counter for detec-tion of radiation. Priced at about \$25, this instrument weighs only 14 lb. and measures 14x3x5 in. Power is supplied by a flashlight battery.—End

New "MIDGET SUBSTATION" makes lamps burn brighter, last longer

G-E INDUCTROL POWER PACK

**combines breaker, transformer, regulator in
one convenient package**

If your plant has combined light and power circuits, you may have noticed how illumination can fall off during plant load peaks. You may also have had trouble with shortened lamp life due to overvoltage.

In either case, here's a brand new "packaged" answer to better voltage regulation—the G-E Inductrol Power Pack.

The new Inductrol unit is, in effect, a midjet load-center substation, combining circuit breaker, transformer, and induction voltage regulator in one convenient, space-saving package. It takes the 480 or 600 volts from your power line and converts it to the uniform 120 volts required for maximum lamp output and life. For greater production, more accurate testing, and better performance of electronic equipment, investigate the new G-E Inductrol Power Pack. Contact your G-E sales representative, or authorized G-E agent—or mail your coupon today.

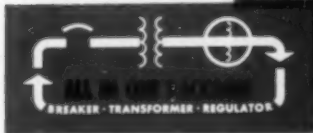
Apparatus Dept., General Electric Co., Schenectady 5, N. Y.



G-E Inductrol Power Packs on factory's roof truss are housed in attractive, completely metal-enclosed, easily installed cabinets.



**INDUCTROL
POWER PACK**



General Electric Co., Section K 321-73
Apparatus Department
Schenectady 5, N. Y.

Please send me Bulletin GEA-5371 on the new G-E
Inductrol Power Pack.

Bulletin needed for:

☐ Reference purposes
☐ Planning an immediate project

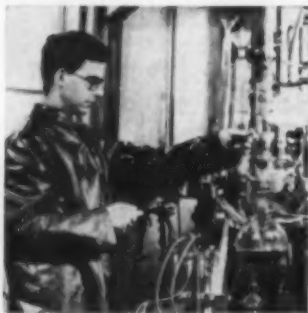
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GENERAL  ELECTRIC



Radio-tracers helped researchers blueprint properties of Isopestox molecule: selective if applied to roots, non-selective when sprayed.

New Insecticide Is Selective— It Kills Only Bad Bugs

When Isopestox is applied to the roots of a plant, the sap stream will carry it to the feeding places of damaging insects. Oral toxicity is low; Isopestox can only exist in the plant's system 1-2 weeks. (164A)

After the launching last year of the first systemic insecticide, Pestox 3, Pest Control Ltd. of Harston, England, has introduced its new, far less toxic offspring Isopestox. It was discovered by the company's Dr. G. S. Hartley.

Dow Chemical Co. is handling both systemics in the United States. Although full scale production of Isopestox will be under way in England very soon, only commercial samples are available at the moment. Dow, as yet, has not made plans for manufacturing it here.

Significance of the new systemics is their selectivity. The insecticides are in the plant, not on it. So any insects such as bees which do no damage are not harmed. Isopestox, therefore, may be applied where there are no beneficial insects—at the roots, for example—and the plant will pick it up and carry it in the sap stream.

Isopestox is, chemically, bis isopropylamino fluorophosphine oxide. The pure chemical is a solid, melting at 60 deg. C., and is very hygroscopic. It is formulated, therefore, as an anhydrous solution containing 50 percent Isopestox. It is non-volatile, odorless, non-corrosive. In the commercial formulation a warning color, methyl violet, is added.

Its oral toxicity to rabbits and guinea pigs is not very high; the median lethal dose is 80 to 100 mg. per kg. That means it's 26 times less toxic than Parthion, 9 times less toxic than nicotine, and a little more than twice as toxic as DDT.

Isopestox is not selective when sprayed on plants, but it will kill aphids, red spiders, thrips, white fly and their larvae, scale insects and mealybugs. As it is not volatile, it has no fumigating action.

Rapidly attacked by the enzymes of the plant, its half-life is only seven to eight days in an active plant in summer.

Isopestox is applied as a spray in concentrations of between 0.05 and 0.1 percent. Its usefulness lies in: treatment of crops infested with thrips, white fly larvae, mealybugs, etc., which are not killed by Pestox 3; treatment of crops nearer to harvest time when the application of Pestox 3 is not possible because there would not be a clear period of four to six weeks between spraying and harvesting.

With the development of Isopestox, Pest Control has taken a healthy step toward its aims for systemics: (1) to kill pests which could not be killed before; (2) to produce further selective methods of application; (3) to pro-

duce systemic insecticides less toxic to man. Many of the more powerful systemics, when sprayed on plants, are not selective and kill beneficial insects and pests alike. Since the systemic insecticide, however, has the remarkable feature that the plant will transport the insecticide from the part sprayed to other organs, Pest Control thought it might turn the non-selective systemics into selective insecticides merely by bringing them on to, and into, the plant at a place where no beneficial insects exist.

Thus in the course of the development of Isopestox the chemists already had many physical and chemical properties of the finished molecule in mind. Research on all the systemics has been greatly facilitated by the use of the radio-tracer method. This method is based on the building into the molecule of atoms of a radioactive isotope of phosphorus which permits tracing the tagged atom. By this means it can be shown that the plants translocate the systemic chemical and its whereabouts in the plant can be pinned down. The method also permits very sensitive analyses; extremely small quantities of radioactive substances can be measured where chemical methods could not trace them.

Pest Control Ltd. and its American co-operators, Dow Chemical, in conjunction with the health authorities, have done a great deal of work on the decomposition of Pestox 3 in the plant. This is important because it determines the length of time during which the plant remains toxic to the aphids and how quickly it becomes safe for consumption. Observations have revealed that this chemical is decomposed by the plant's enzymes, and that

Photos courtesy of Pest Control Ltd.

it is destroyed in three to four weeks when the plant is active. Even allowing for a safety margin, no trace of a toxic residue is left six weeks after spraying, and consumption is safe. With Isoposox, of course, a much narrower time-margin has been found safe.

Thermosetting Plastic

Flame-resistant; electrical properties withstand heat, humidity. (165A)

A third type of alkyd molding compound has been added to the group of thermosetting plastics produced by the Plaskon Division, Libbey-Owens-Ford Glass Co. Designated Plaskon alkyd 422, it will be sold in granular form.

Comparable in most other respects to the present compounds of this type (Plaskon alkyls 411 and 420), the new material is listed as self-extinguishing under ASTM and Underwriters Laboratories flame resistance tests. It retains its electrical properties on exposure to high humidities and temperatures and, as further evidence of its general moisture resistance, quickly regains its electrical properties after periods of immersion.

Cyanoacetamide

Suggested intermediate for special resins, substituted piperidines and pyridones, new pharmaceuticals. (165B)

Both a nitrile and an amide, cyanoacetamide is an intermediate with a very reactive methylene group. Its developers, Kay-Fries Chemicals, point out its part in the synthesis of condensation products and resins useful in the treatment of textile fibers and as purifiers for gases and liquids. These are obtained by condensing formaldehyde and certain amino-cyanoacetamides. The amino-cyanoacetamides, in turn, are obtained directly from cyanoacetamide and alkylene diamines.

The cyano-activated methylene group enables it to combine with aldehydes and ketones in several ways to give varied products. With aldehydes, for example: (1) A substituted cyano-glutarimide and a substituted pentane cyano-tri-carboxyl-amide are the products of combination with aldehydes (generally low molecular weight) in the presence of a catalyst; (2) Two substituted piperidines result from condensation with higher molecular weight aldehydes (iso-valeraldehyde, oenanthal, benzaldehyde) in

the presence of a catalyst. With ketones: (1) Two moles of cyanoacetamide combine with one mole of ketone to give two substituted piperidines, as with the aldehydes; (2) Only one mole combines with one mole of a diketone or an unsaturated ketone to give several substituted pyridones; (3) Two pyridone isomers can be made by the catalyzed reaction of an α, γ diketone with cyanoacetamide. This type reaction is used to produce intermediates in the synthesis of Vitamin B.

A solid melting at 119 deg. C, the chemical is already being used in the preparation of vitamins and barbiturates. It comes packed in 125, 100, 50, 25 or 5 lb. fiber drums.

Plasticizing Resin

To plasticize nitrocellulose lacquer films and to improve their adhesive qualities. (165C)

Now in pilot plant production is General Mills' new Resinous Alcohol-8. The mixture of the mono-, di- and tri-glycerides of rosin and fatty acids has a small number of free hydroxyl groups. Its resinous characteristics come from the high ratio of rosin acids to fatty acids in its glycerides. Physically, it is a light-colored, viscous, non-crystallizing liquid. At temperatures below 100 deg. C. it is fluid enough to be pumped.

In controlled tests, nitrocellulose lacquers containing Resinous Alcohol-8 produced hard, flexible, water-resistant and alcohol-resistant films. These films on mahogany plywood survived more than ten 60-min. cold check cycles of 120 to -20 deg. F.

The product is completely soluble in lacquer solvents. And it is compatible, not only with nitrocellulose, but also with many other natural and synthetic resins and plastics and with most common lacquer plasticizers. Relatively non-volatile and non-migratory, it does not evaporate from nitrocellulose films as they age.

Drum quantities are available for evaluation and commercial use.

Sponge Rubber Blowing Agent

Free flowing, dry powder goes twice as far as sodium bicarbonate. (165D)

Non-toxic soda-type Ansul Blo's uniform particle size provides fast, even dispersion throughout the rubber. Ansul Chemical Co. reports plant tests which show that the quantity

New This Month . . .

	Page & Item
Selective Insecticide	164A
Thermosetting Plastic	165A
Cyanoacetamide	165B
Plasticizing Resin	165C
Sponge Rubber Blowing Agent	165D
Powdered Dispersed Colors	165E
Aero Cyanuric Chloride	166A
Fast Color Bases	166B
Ammonium Bicarbonate	168A
Copper Ammonium Fluoride	168B
Detergent Cleaning Compounds	170A
Metal Conditioning Primer	170B

For More Information . . .

Use the Reader Service card inside the back cover. Circle the number of item which you want to learn more about.

needed in a formula is only about half the amount of equivalent sodium bicarbonate to give a complete, even blow.

In addition to natural rubber, such synthetics as GR-S and the Neoprenes have been successfully treated with Ansul Blo. It shows very little tendency for leaching out of the finished sponge and premature blow is eliminated.

The product has been designed for water repellance and resistance to lumping and caking under adverse conditions of storage and handling. It is nondiscoloring and both the compound and its breakdown products are odorless.

Powdered Dispersed Colors

For producers of calendered and extruded vinyl film sheeting. Maximum color strength, uniform color particle size. (165E)

Made up of 50 percent organic pigments and 50 percent vinyl resin and dioctyl phthalate, the products in a new series of dispersed organic pigments are in powder form. Vansul & Co., Englewood, N. J., designed them for the pre-blending or dry blending techniques used in coloring vinyl film and sheeting. A ready-mix with dry vinyl resin made prior to fluxing, results in rapid and complete dispersion after fluxing.

Because of their free-flowing, non-dusting properties, the powders are not messy to handle, will not cause contamination between batches. It has been found that a minimum of cleaning is necessary where various powdered dispersed colors are mixed successively in the same pre-blender.

Superior color strength is developed because of complete color dispersion. The colors are produced in approximately the same particle size as the vinyl resin itself. Vansul has an ex-

(Continued)



A ONE MAN "FIRE ENGINE"

—the Kidde Wheeled Dry Chemical Extinguisher

You can control a roaring fire in inflammable liquids, live electrical equipment, textiles or L-P gas. The Kidde 150 Pound Dry Chemical Wheeled Extinguisher packs a fire-fighting wallop that brings large fires under control quickly and easily.

The new "instant flow" hand control enables you to beat back fire with a long range "straight" stream...or to blanket the fire completely by the wider coverage of the improved "fan" pattern.

One man can wheel this extinguisher through a standard doorway...apply 150 pounds of fire-smothering dry chemical in less than one minute.

Write for full information on this new Kidde dry chemical extinguisher...or the full line of Kidde extinguishers and built-in systems.

Kidde

Walter Kidde & Company, Inc.

728 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

NEW PRODUCTS, cont. . .

clusive colloidal process which gives not only a uniform color particle size, but develops a maximum of color strength—often 25 percent above the actual color content. The powders are said to mix well in the pre-blender without flying and yield excellent dispersion during subsequent mill or Banbury mixing or in the barrel of plastic extruders.

The product is still in the development stage but quantities up to 500 lb. will be available shortly. Range of pigments includes disazo yellows and oranges, BON reds, pyrazalone reds, phthalocyanine blues and greens.

Aero Cyanuric Chloride

Large-scale quantities and new applications, coming up. (166A)

American Cyanamid formerly produced cyanuric chloride, principally for dyestuff manufacturers, in pilot plant quantities. Now the company has developed applications in the manufacture of resins, pharmaceuticals, explosives, rubber chemicals, moth-proofing agents, surface-active agents and plasticizers. And two units of a new plant have already gone into operation.

Present and future shortages of many coal-tar intermediates, such as resorcinol, now being felt by dyestuff manufacturers, may be lessened by this raw material which offers them a reliable source of supply. Up to now they have been using it mainly in the production of whitening agents.

A colorless, crystalline solid, the product is easily hydrolized by water but stable in the anhydrous state. It is easily soluble in acetic acid, ether heptane and acetonitrile, but sparingly soluble in benzene, acetone, chloroform and nitrobenzene. Below 10 deg. C, the compound is almost insoluble in water; above this temperature, hydrolysis is rapid.

Fast Color Bases

Potential uses wherever rapid mixing with naphthols is desirable. (166B)

A new series of stable fast color bases called Spectrolenes makes possible rapid mixture with combinations of naphthols for numerous brilliant shades. Hilton-Davis Chemical Co. tests have already proved them effective for textile dyeing and printing and diversified applications are now being explored.

The bases are completely diazotized and stabilized to prohibit coupling (Continued)



How Celite Mineral Fillers give a product delicate abrasiveness...



Putting a "Soft" shine in polishes

TO PRODUCE A POLISH that is scratch-free—yet contains exceptional cleaning powers—most leading manufacturers of fine polishes use one of the Celite Mineral Fillers as a standard ingredient.

This use of Celite Fillers is based on

their delicate non-scratching abrasive action—a property that derives from their porous, thin-walled cellular structure. It is one of many unusual physical characteristics that adapt these diatomaceous silica powders to numerous industrial uses.

THESE CELITE PROPERTIES BENEFIT MANY TYPES OF PRODUCTS

Because of their inertness and great bulk per unit of weight, Celite Mineral Fillers make ideal bulking agents for powders and pastes. Their tiny multi-shaped particles interlace to stiffen and strengthen admixtures. The microscopically small facets of these particles diffuse light so effectively that they can be utilized to impart any desired degree of flatness to a surface film. Their light, porous nature improves suspension, helps prevent segregation. And

their high absorption properties and unique diatom structure make them unusually effective as a means of overcoming caking in deliquescent materials.

If you are looking for the "extra something" to lift your product above competition—at a negligible cost—why not discuss your problem with a Johns-Manville Celite Engineer? For further information and samples, write Johns-Manville, Box 290, New York 16, N. Y.

CHECK LIST OF PRODUCT BENEFITS OBTAINABLE AT LITTLE COST WITH CELITE MINERAL FILLERS

- Added Bulk
- Better Suspension
- Faster Cleaning Action
- Greater Absorption
- Improved Color
- Better Dielectric Properties
- More Durable Finish
- Increased Viscosity
- Elimination of Caking
- Higher Melting Point
- Better Dry Mixing
- Improved Dispersion



Johns-Manville CELITE®

MINERAL FILLERS

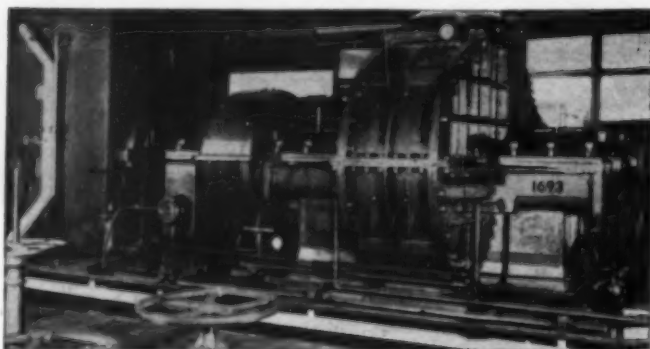
NEW R-C EXHAUSTER

pays its own way

By replacing a 30-year-old battery of three steam-driven gas exhausters with a new, high-capacity, electrically-driven R-C unit, important advantages were gained, in a large industrial plant:

1. The one new unit carries the base load.
2. Steam needed for 5 other steam-driven exhausters, carrying partial load, is substantially reduced because of slower speeds.
3. Heat balance in the plant is maintained.
4. Savings in total power cost will pay for the new installation in about one year.

These very satisfactory results were obtained by careful evaluation of all the factors before deciding upon the type of equipment . . . and then by specifying an R-C Rotary Positive Gas Exhauster that will do the work at low operating cost.



Type RCGH Rotary Positive Gas Exhauster, driven by 430 hp synchronous motor. Capacity, 20,600 cfm.

Even though your equipment to handle gas or air may still have years of life, it may be sound economy to replace it with modern, efficient, R-C units of the right type, size and drives to best meet your needs. Our engineers will help you analyze your problem and make unbiased recommendations of either Rotary Positive or Centrifugal equipment, depending upon your specific conditions. This dual choice is an exclusive R-C advantage.

With capacities from 5 cfm to 100,000 cfm, R-C units can be closely matched to work requirements, for dependable, economical performance. At Roots-Connorsville, almost a century of blower building experience is at your service, without obligation.

ROOTS-CONNERSVILLE BLOWER CORP.
151 Illinois Avenue, Connorsville, Indiana



Type OHS Centrifugal Blower in chemical plant. Capacity 19,600 cfm.

ROOTS-CONNERSVILLE

ONE OF THE DRESSER INDUSTRIES



with naphthols in solution or with naphtholated material, until the stabilizer is broken down. The base is released from the stabilizer by the action of acid or acidified steam, such as acid ager. This permits complete coupling of the naphthol with the Spectrolene.

Hilton-Davis reports that loss of color value due to prolonged storage has been cut to a minimum. Additional brilliance and color value are made possible because the Spectrolenes are mixed fresh with the naphthols in the plant where they are actually applied.

The five bases, available in solution form, are: Red KB, Red RC, Scarlet 2G, Orange HD and Blue B. They are supplied in drums of 450 lb.

Ammonium Bicarbonate

For manufacture of baking powder, pharmaceuticals. (168A)

A food grade ammonium bicarbonate having an average ammonia content of 21.6 percent has been made available to American industry by Chemical Mfg. Co., San Francisco. A product of Imperial Chemical Industries, England, it is a fine, white crystalline material and is available in 224-lb. drums for immediate delivery.

In the manufacture of baking powder and biscuits, the product leaves no residue or taint. Volatilization by heat and resultant aeration are excellent. Ammonium bicarbonate also finds use in dispensing and in the manufacture of pharmaceuticals. It is of value to manufacturers of ammonia salts, to rubber manufacturers for inflators and as neutralizer for ammonium sulphate prepared at gas works and coke ovens.

Copper Ammonium Fluoride

Powdered complex more stable in dilution than liquid forms. For termite- and rot-proofing wood, mildew-proofing textiles. (168B)

A free-flowing, powdered copper ammonium fluoride complex, soluble in water, has been made available for evaluation purposes by the Pennsylvania Salt Mfg. Co.

The dry formulation improves on liquid copper ammonium fluoride solutions in that dilutions as low as 0.04 percent copper may be made without the necessity of adding ammonium hydroxide to maintain stability.

Studies with a variety of woods indicate that Pennsalt's CAF, when dis-

(Continued)



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and quality

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. . . are also valuable in its use in the dyeing industry . . . in production of
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SODIUM FORMATE

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extra CAPACITY... Types SVC and SEC single-stage Process Pumps handle liquids from sub-zero to 800°F.; 15 to 1600 gpm; 500 to 800 psig pressure; heads up to 600 feet; speeds to 4,000 rpm. Type RVC two-stage Process pumps handle liquids from sub-zero to 850°F.; to 600 psig pressure; heads to 825 feet; speeds to 3,600 rpm. All 3 types available with suction diameter from 1½" to 8"; discharge diameters from 1" to 6".

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solved in water and diluted to 0.5 percent copper, exhibits excellent penetration characteristics. After drying, the wood shows resistance to leaching superior to similar samples treated with zinc chloride or copper sulphate.

Detergent Cleaning Compounds

They dissolve not only water-soluble soils but also water-insoluble soils normally removed only by organic solvents. (170A)

A new class of cleaning compositions, based on a chemical principle long known but not heretofore applied commercially in the detergent field, has been announced by the Pennsylvania Salt Mfg. Co.

The action of Solubilizing Cleaners is based on oversize micelles or groups of molecules which have the property of dissolving not only water-soluble soils taken up by normal soap solutions but also water-insoluble soils which can normally be removed only by organic solvents.

Today Pennsalt has four of these products, already undergoing field tests and in semi-commercial production. These are SC-3, SC-21, SC-23 and SC-24. Preliminary application studies and field tests indicate their value in a variety of specialized uses in metal cleaning, certain other types of in-process cleaning, maintenance cleaning.

The SC products are clear liquids, yellow, dark brown or cherry red in color. They are specially formulated to reduce the probability of industrial dermatitis due to skin defatting. Vapor toxicity does not exceed that of usual emulsion cleaners. They have a practical neutral pH, good solubility and dispersibility in water, moderately high flash point, and exhibit a high adsorption at interfaces.

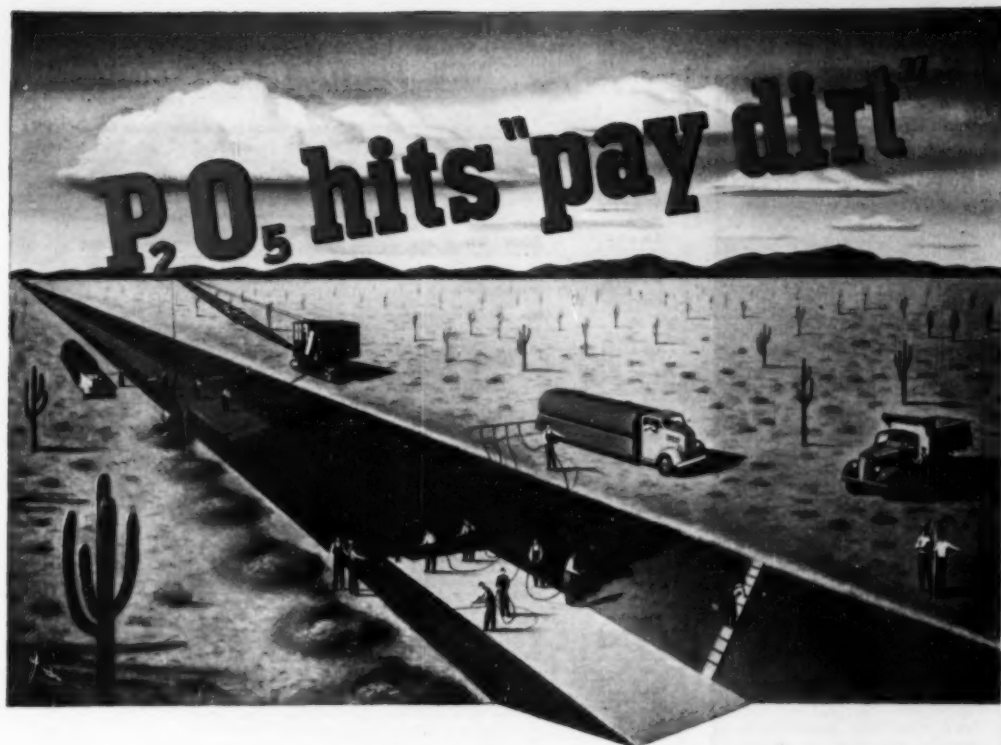
Metal Conditioning Primer

To prevent corrosion, promote adhesion of finish coats. Ordinary application methods and equipment. (170B)

Resin-based Ferrotite developed by Baltimore Paint & Color Works eliminates the need for surface preparation of ferrous metals, aluminum and magnesium alloys.

Spray gun, brush, roll coater or dip application may be used. Ferrotite can be recoated after 5-10 min. air dry time. The finished system, when baked at 325 deg. F. for 15-20 min., will resist acetone. —End

CP-3



Petroleum Industry Benefits from Use of Victor Chemical—Victor phosphoric anhydride is being used profitably as a catalyst in the preparation of asphalt for large irrigation ditches. The P_2O_5 eliminates softening at high temperatures, prevents brittleness during low temperatures, and saves costly replacement or repairs.

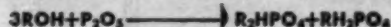
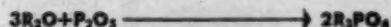
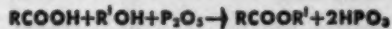
This new catalytic type asphalt also provides additional benefits. Now it is possible to increase irrigation and reclaim arid land which previously was impractical due to high construction costs.

You, too, may find the answer to an unusual product problem with highly reactive Victor phosphoric anhydride. P_2O_5 and other versatile Victor chemicals merit your consideration. Please write for technical data or other information, on your company letterhead.

Other applications in which Victor phosphoric anhydride has proved useful

- **GAS DRYING AGENT**
- **REAGENT IN METHYL METHACRYLATE RESINS**
- **PRODUCTION OF ORGANIC PHOSPHATES**

TYPICAL REACTIONS OF VICTOR PHOSPHORIC ANHYDRIDE



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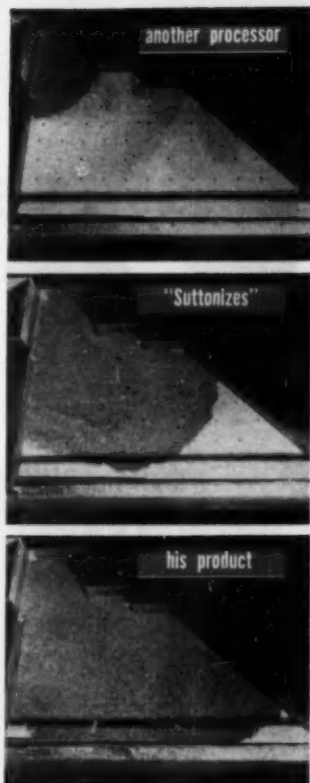
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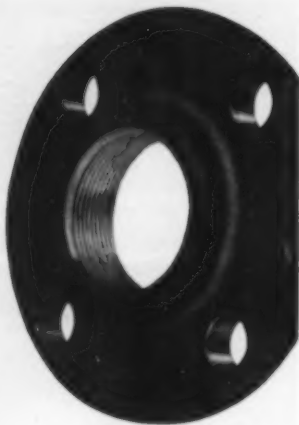


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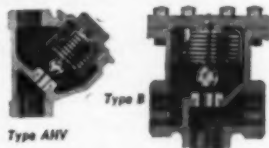
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Large Processor Achieves

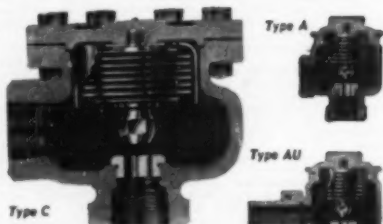
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Votator

PROCESS NEWS

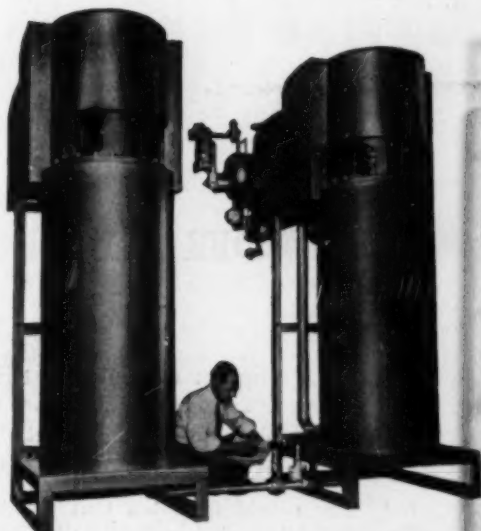
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Liquid resins and other chemical products, for instance, can be cooled to predetermined temperatures at rates from 20,000 to 30,000 lbs. per hour. Depending on the heat-transfer medium used, materials can be heated as high as 700°F, or cooled as low as -150°F.

Only a small quantity of material is processed at any one time, at high speed. Thus heating or cooling is accomplished quickly and efficiently. Close control over the entire operation assures complete uniformity of product, prevents contamination. The whole operation is faster, cleaner, more economical—and takes far less floor space than other methods.

In addition to heating and cooling, VOTATOR Heat Transfer Apparatus can be used for crystallizing and controlling heats of reaction. Girdler's complete service covers process engineering and design, manufacture of equipment, and installation. The Girdler Corporation, Votator Division, Louisville 1, Kentucky.



VOTATOR 24" Heat Transfer Units—heavy duty processing apparatus for the chemical field. Among products involving straight heating or cooling now being processed with VOTATOR Heat Transfer Apparatus are: phenolic resins, formaldehyde resins, alkyd resins, melamine resins, vinyl resins, wax, viscose, resin, printing ink, chlorinated hydrocarbons, latex, asphalt emulsions, photographic emulsions, wax emulsions, linseed oil, lecithin, gelatine, and petroleumum.

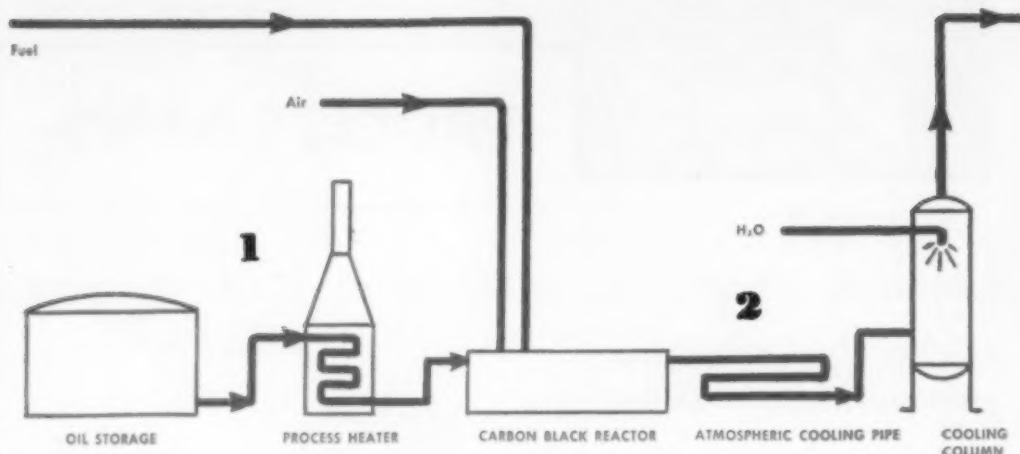
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VOTATOR—T.M. Reg. U. S. Pat. Off.

THE **GIRDLER** CORPORATION
Votator Division



Carbon Black

Fold out
pictured
flowsheet
→

Biggest customer is the rubber industry. Synthetic rubber has made furnace blacks more popular. Here is the way a modern carbon black unit helps meet the expanding needs of its most important market. Many new plants are being built.

Feed stock is natural gas or oil Raw material for carbon black is either natural gas or liquid hydrocarbons. They use the latter at the Philblack plant in Borger, Tex. Here the Phillips Chemical Co. (a subsidiary of Phillips Petroleum Co.) turns out medium abrasion and high abrasion furnace blacks—so named because of the kind of resistance they impart to rubber products.

The feed stock used at the Philblack plant is an oil with high carbon to hydrogen ratio from the nearby Phillips Oil Co. refinery. The process is sufficiently flexible that a considerable range of oils may be used.

First preheat oil First step in the operation is the preheating of oil to temperatures near or above the vaporization point of the feed. The two types of carbon black are produced at the plant in reactors, especially designed for each type.

Form furnace black The hot feed is vaporized or atomized into the reactor depending on the feed stock being used. A portion of the feed burns, furnishing heat to maintain the temperature of the chamber at the carbon-black-forming temperature. The reaction is a combination of incomplete combustion and thermal decomposition of the feed stock.

A water quench near the outlet of the reactor cools the carbon black and gaseous products. Temperature is further reduced in passing through an atmospheric cooling pipe and water spray column. The black is separated from the gaseous stream by means of extremely high voltage in electrical precipitator equipment followed by a battery of cyclone separators. From the collecting equipment the product moves by screw conveyors to the hammer-pulverizer where it is ground before being charged to rotary pellet mills. The black goes by screw conveyor from the pulverizer to the pellet mills. In these mills the tumbling action makes the black into very small pellets and increases the bulk density. Pelletizing in this manner reduces the dusting problem in the handling of the black in bagging for storage and in loading and shipping both in bags and hopper cars.

Cool the products The pelleted black moves by conveyor belt to bulk storage or bagging machines. The bagged black is moved to warehouse storage and from there to railroad cars by conveyor belt. Overhead tanks are used at the plant for loading of bulk black into covered hopper cars.

Pulverize then pelletize

Ship it in bags or hoppers

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costs more
now!**

**You'll spend less for it
with Dependable Quality
CRANE VALVES**

*...That's why
more Crane Valves
are used
than any other make*

◀ High Corrosion Resistance at Low Cost

Crane No. 14477 Alloy Cast Iron Gates give excellent service where "all-iron" or "brass trimmed" valves fail, due to corrosion of seating surfaces. Body rings, stem, and disc-faces are Crane 18-8 Mo. Conditions permitting, these valves, with low nickel alloy cast iron body, are ideal substitutes for hard-to-get, more expensive, all 18-8 stainless steel valves.

O.S. & Y. design keeps stem threads from contact with line fluid; straight through ports assure unrestricted flow, minimize turbulence and corrosive action. Extra-long guides keep disc travel true.

Your Crane Representative will gladly show you why Crane Valves give better performance at lower ultimate cost—why you should insist on Crane Quality.

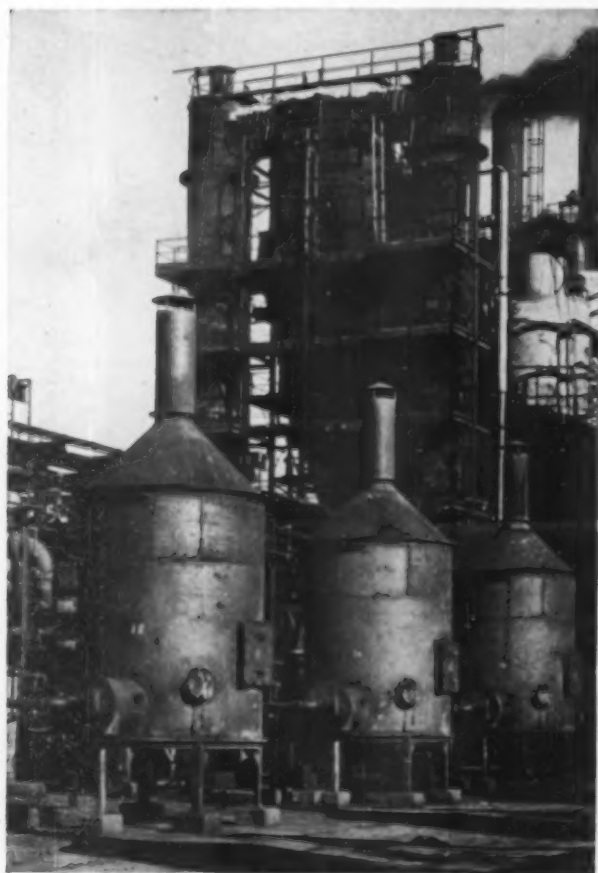
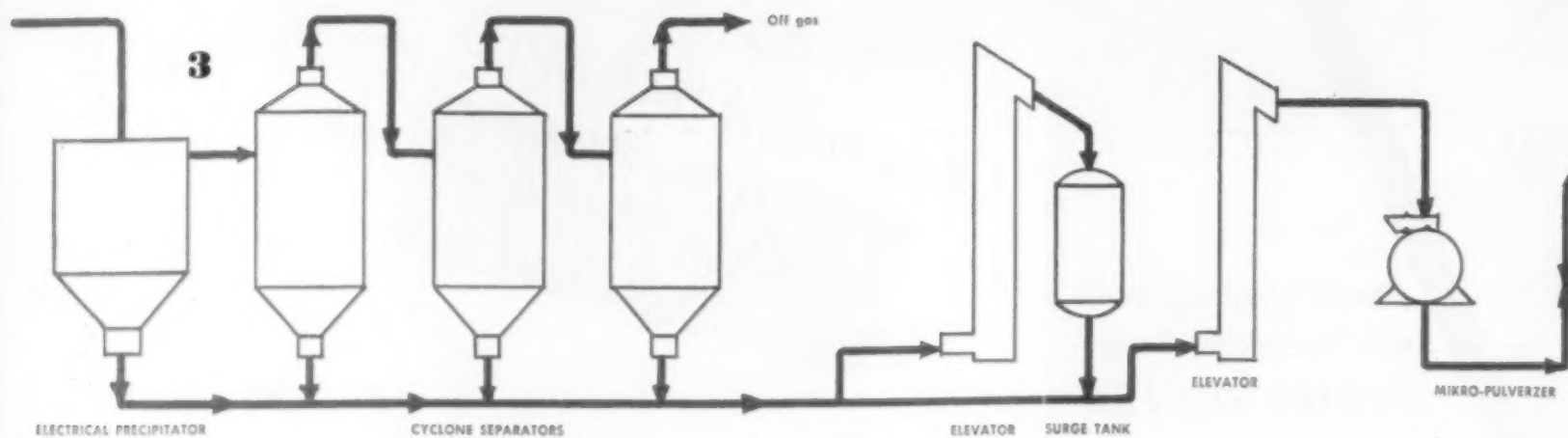
Crane Alloy Cast Iron Gate Valve,
18-8 Mo. trimmed. 300 Pounds W.O.G.

CRANE CO.

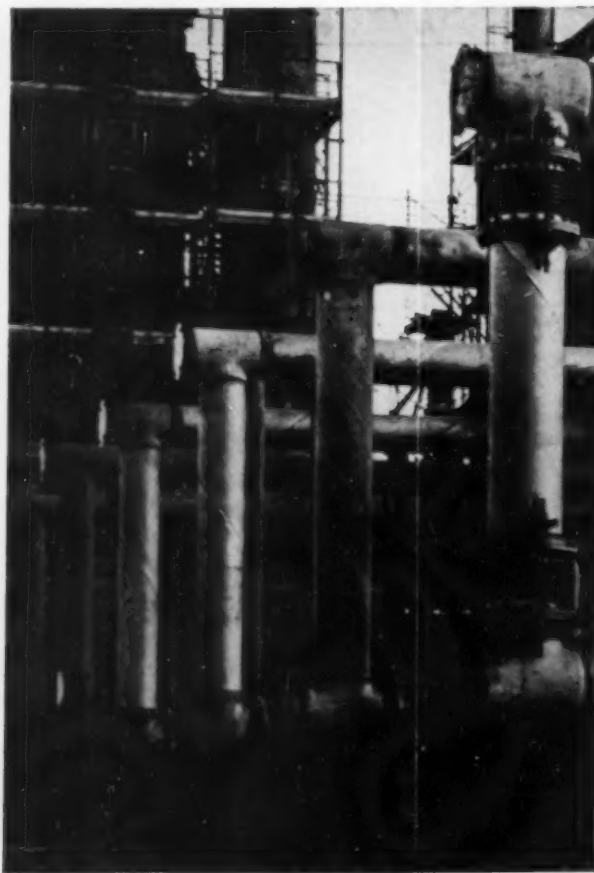
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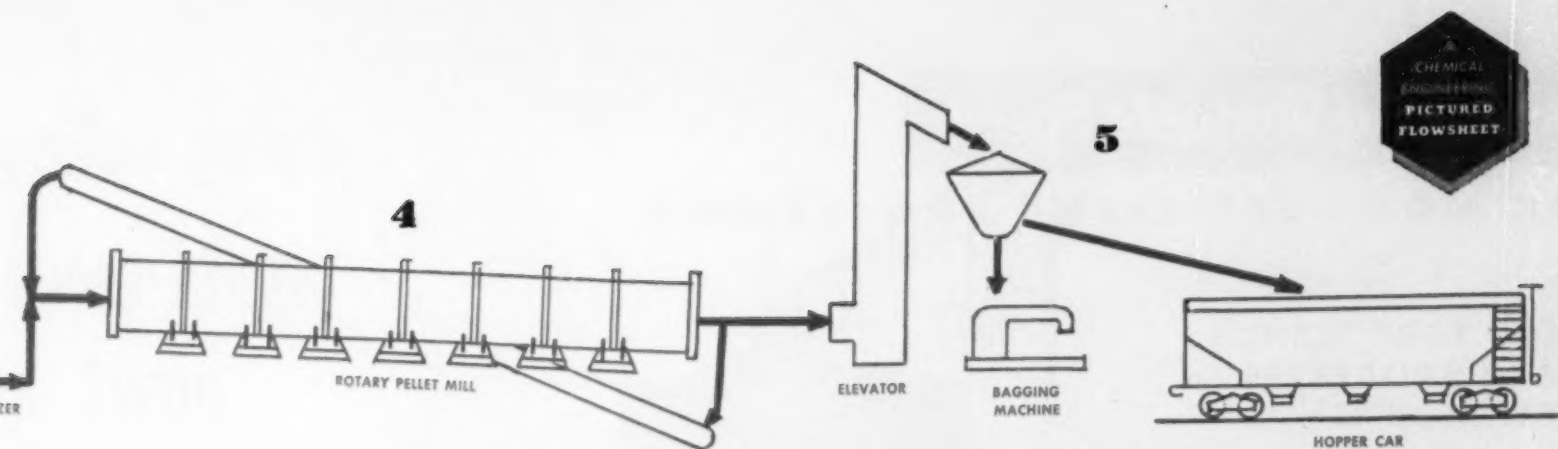
1 Preheaters are used to bring the oil feed stock to temperatures near vaporization point before feeding it to reactors where black forms.



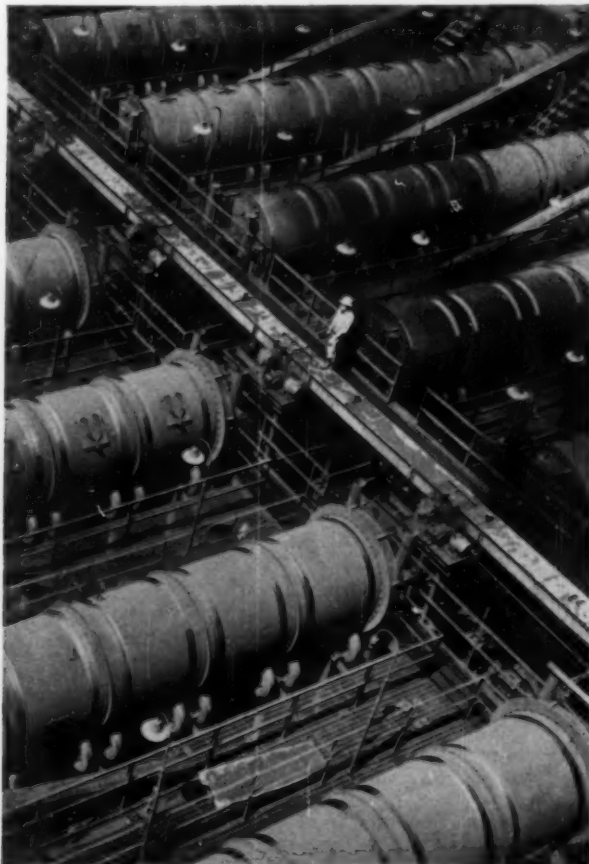
2 Carbon black and gaseous products are given a water quench, then passed through these atmospheric cooling pipes. Next they pass to a tower.



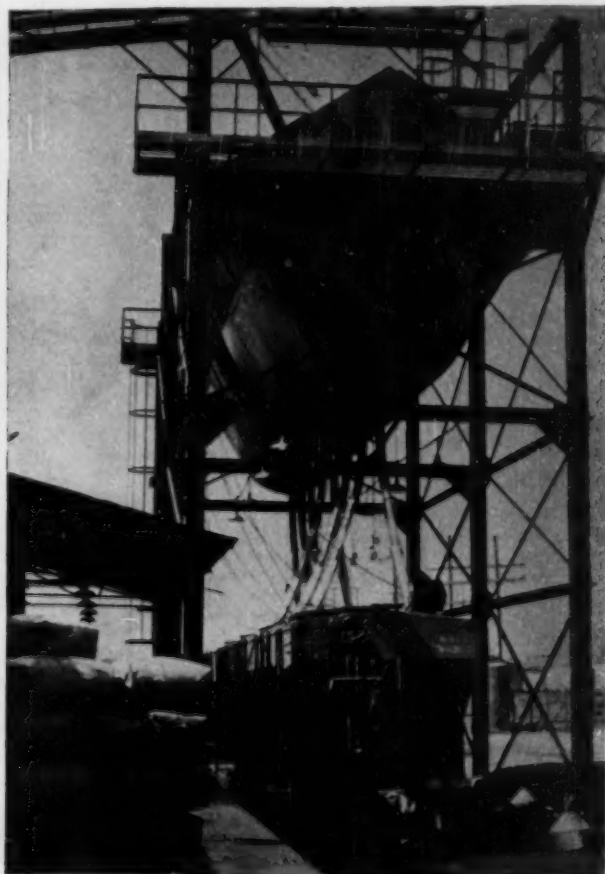
3 Carbon black collection equipment: precipitator, cyclone separator, bucket elevator.



ent includes spray cooler, electrical
ket elevators and surge tank.



4 Rotary pellet mills convert light fluffy furnace black into spherical pellets. This improves handling, cuts dust, permits bulk shipments.



5 Overhead storage tanks like this huge unit are filled by an elevator system. Covered hopper cars and multi-wall bags carry it to market.

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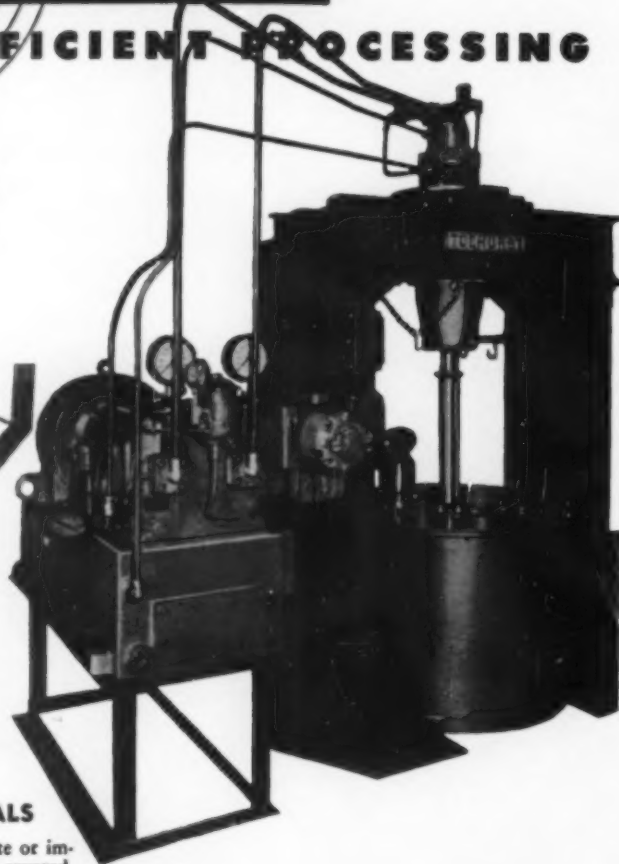
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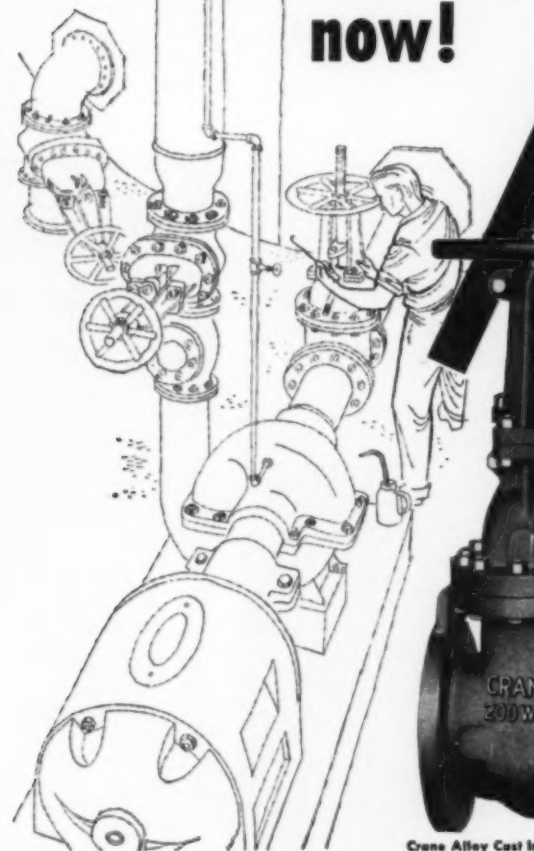
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Crane Alloy Cast Iron
18-8 Mo. Rimmed, 20

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VALVES • FITTINGS • PIPE

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High Corrosion Resistance at Low Cost

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Cast Iron Gate Valve,
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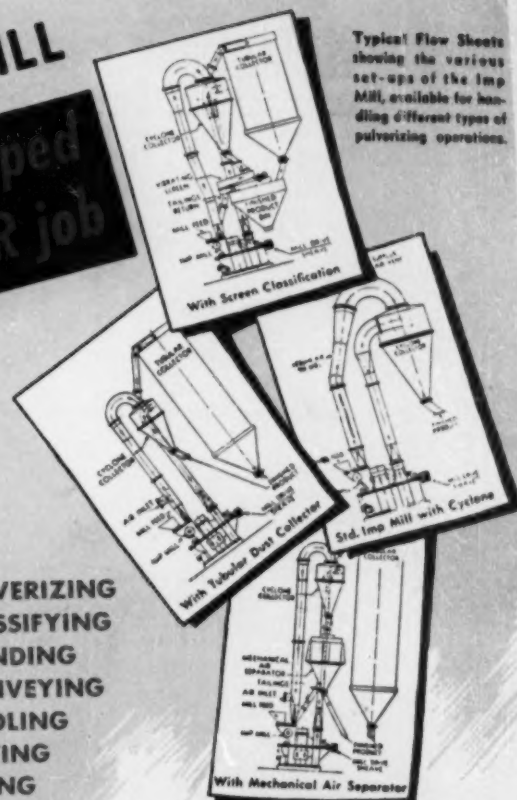
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Typical Flow Sheets showing the various set-ups of the Imp Mill, available for handling different types of pulverizing operations.

This versatile fine grinding unit provides a flexible installation that can in many cases offer vastly improved products and greatly simplify processes.

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For grinding, blending, and classifying various chemicals to fine, uniform powders; removing "water of crystallization" from hydrate compounds; and other unusual jobs, the Imp Mill provides automatic and economical production, as well as clean and dustless operation.

The Raymond Imp Mill may be the answer to your production problem. For further details, write for Imp Mill Catalog No. 67.

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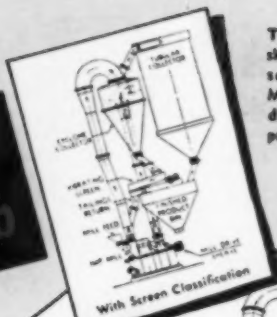
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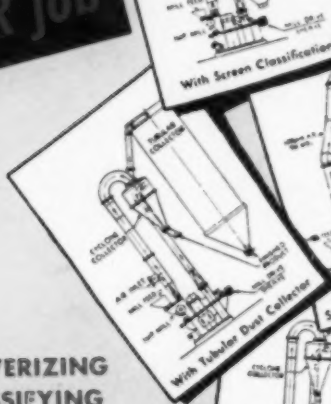


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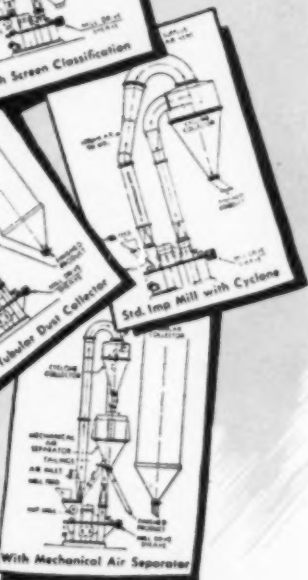
- PULVERIZING
- CLASSIFYING
- BLENDING
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- DRYING
- FIRING



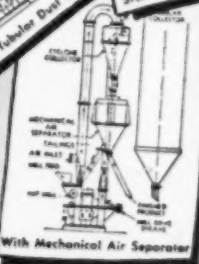
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Std. Imp Mill with Cyclone



With Mechanical Air Separator

Typical Flow Sheets showing the various set-ups of the Imp Mill, available for handling different types of pulverizing operations.

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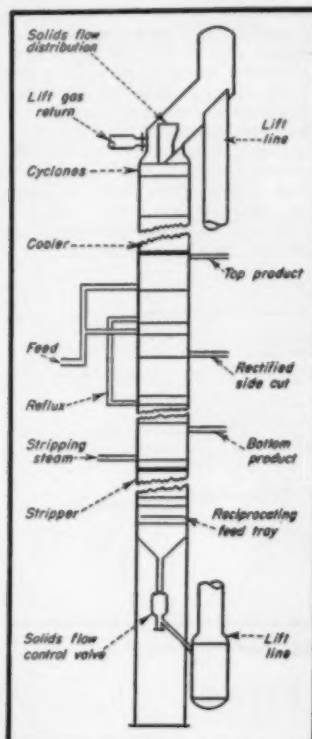
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Latest in Hypersorbers

New units, improved designs, widening uses again focus attention on the process possibilities of hypersorption as a versatile tool in chemical operations.

Next month the largest hypersorber unit yet built will go on stream at the Midland, Mich., plant of Dow Chemical Co. It'll recover ethylene and other hydrocarbons from cracked natural gas.

A smaller unit may soon be put up by another firm to recover acetylene from a generator using natural gas as feed. This will be the first use of hypersorption for recovering acetylene on a semi-commercial scale.

Other processing companies, meanwhile, are taking a closer look at the hypersorber as a tool for separating volatile hydrocarbons and other gases in chemical, refining and natural gas operations.

One thing is now certain: hypersorption—developed by Union Oil Co. of California—is fast becoming a process to be reckoned with.

Hypersorption uses a moving bed of activated carbon to adsorb and fractionate the components of a gas stream. Adsorption gives unusual selectivity for recovering and separating relatively volatile hydrocarbon gases. Activated carbon provides the retention necessary for efficient recovery of these volatiles, yet it allows easy desorption and stripping.

Dow's new unit—engineered and fabricated by Foster Wheeler Corp., erected by Austin Construction Co.—towers 207 ft. above the ground, is

9.25 ft. in diameter, weighs roughly 400 tons. (See cut: tower before the supporting stifflegs were lowered).

The new unit has two towers in series. One separates methane and lighter constituents from the C_3 's. The other removes C_3 's from the C_2 's. Overhead is largely methane and hydrogen, the side cut ethane and ethylene, the bottoms propane and propylene. Dow separates and purifies these hydrocarbon streams and uses them in its chemical operations.

RECENT ADVANCES

Why is interest in the hypersorption process (now entering its fifth year of commercial operation) reaching a peak? "Part of the answer comes from recent improvements in design that give greater flexibility and better performance," says Union Oil's Clyde Berg.*

Commercial hypersorbers, Berg points out, now have capacities up to 16 million cubic feet per day and can produce as many as four well-fractionated products from a single tower. On-stream efficiencies have been as high as 99 percent of a year's operation. Only part-time attention of one operator is normally needed.

Major improvements have also been made in the gas lift system that's an integrated part of modern hypersorbers. Attrition losses of carbon in commercial plants now approach 0.001 percent per cycle—a reduction of 80-90 percent from losses in the earliest units operated.

One modern hypersorber design (see cut) allows re-fractionation of the side cut stream. This is done by countercurrent contact with a bed of uncontaminated activated carbon that's delivered directly from the top of the unit. This construction is useful for producing ethylene streams of very low C_2 content and for pure acetylene streams. It can, in general, be used where the purity of the side cut stream is important.

Here a separate stream of activated carbon goes internally to the section giving final purification of the side cut. Location of the solids splitting trays gives precise distribution of the flowing activated carbon between the side cut rectifying section and the other beds that carry out adsorption, rectification and stripping.

A hypersorber giving a rectified side
(Continued)

* American Institute of Chemical Engineers in Kansas City.

cut is valuable in processing refinery gas streams to produce ethylene and recover propane and ethane. A typical plant using ethane cracking for maximum ethylene production might have a hypersorber feed of about 12 percent hydrogen, 35 percent methane, 13 percent ethylene, 25 percent ethane, 4 percent propylene, 8 percent propane and 1-2 percent C₄'s and higher.

Overhead from the hypersorber would then be close to 25 percent hydrogen and 73 percent methane; the bottoms would be about 29 percent propylene, 54 percent propane

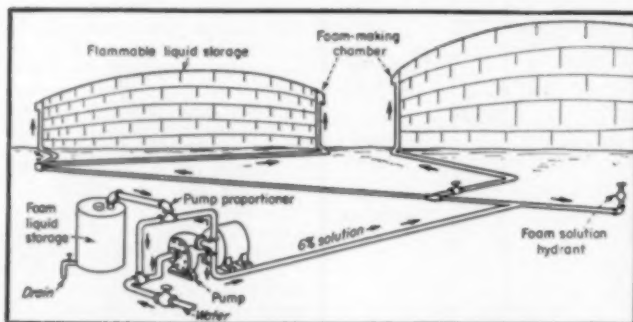
and 11 percent C₄'s and higher hydrocarbons.

Side cut from such a unit would be approximately 39 percent ethylene and 60 percent ethane. This can be fractionated to an overhead of 97 percent ethylene with only about 1.5 percent each of methane and ethane.

Another recent variation in hypersorber design provides two (or more) feed trays in the tower to double the feed gas throughput capacity. Each section then carries out true counter-current contact of the feed gas with fresh carbon. This design is useful for processing lean natural gas, propane recovery, and for recovering ethylene from coke oven gas.

Construction may be modified to produce four well-fractionated products in a single tower. Here there are two separate fractionating sections. This type can be used to handle refinery gas streams to give one side cut of well-fractionated ethylene, another side cut of propane and propylene and a bottoms product of butane.

When fractionation of two close boiling components is being carried out, heat economies can be made by heat exchange between the top and bottom of the hypersorption unit. This design is restricted to special processing uses, such as separating nitrogen and methane from natural gas.



TYPICAL mechanical foam fire extinguishing system for outdoor storages.

Cut Down Tank Fires

Now, more than ever, it's important for industry to protect its flammable liquids against fire loss. Here are timely tips on how to safeguard your tank farms.

Last year American industry dished out close to \$103 million to pay for fire damage caused by the improper use or storage of flammable liquids.

Some 44 percent of the fires on tank farms, says the National Fire Protection Association, are caused by such hazards as cleaning, spillage, static sparks, riveting or repairing. About 41 percent come from lightning, exposure, grass or incendiary fires. The remainder have undetermined causes.

Many of these costly fires could have been avoided by proper tank design and location and by adequate fire protection, says H. C. Lein of Walter Kidde & Co.

Design and location of the tanks, Lein points out, are of primary importance. Exterior tanks should be covered with a rust-resistant coating. Plate thicknesses on riveted or welded

tanks should be from 1/16 in. for a 200-gal. tank to 1/2 in. for a 30,000-gal. tank.

Don't locate tanks so that burning liquid can flow down hill or be spread by streams, Lein advises. Place dike walls 50 ft. from the nearest tank and don't make them more than half the height of the highest tank. Take special precautions if floods are probable or if the ground water table is near the surface. See that gradings direct rain water into drains controlled by valves that normally are closed but are opened to pass off accumulated water.

Loss of volatile fluids through evaporation can be cut down by protecting your tanks with aluminum paint, water sprays, sun shades or insulation. Many disasters occur for lack of sufficient air intake or escape. Flame arresters are important on ventilation openings.

Be sure that all the tanks are grounded.

Eliminate spark-creating devices and use electrical equipment of the non-sparking type. Do not, ordinarily, handle flammable liquids by air pressure or gravity discharge. Inert gas in the tank eliminates the hazard of an explosive vapor-air mixture.

For flammable liquid storage tank protection, Lein recommends built-in mechanical foam systems; these require only air, fresh or salt water and a foam-producing liquid. The foam blanket adheres to vertical as well as horizontal surfaces, stops the evaporation that supplies flammable gases, kills the blaze and has insulating qualities.

Mechanical foam fire extinguishing systems vary in size and design; the above cut shows the layout of a typical Kidde system for larger outdoor storage tanks.

A pump proportioner is connected between the discharge and suction sides of the water pump. Valve-controlled piping carries the foam solution atop the storage tanks where it is mixed with air. The foam is then spread over the burning liquid within the tank.

One system (Underwriters Type I) delivers foam through a porous asbestos tube directly at the surface of the liquid within the tank. When foam pressure is applied, a coarsely woven asbestos tube, mounted in the chamber, is unrolled and floats on the surface. The foam exudes from the openings in the mesh. The other system (Underwriters Type II) dispenses foam from a fixed overhead position.

In both systems vapor leakage is prevented by a glass diaphragm at the top of the riser. This is sealed in position. Foam pressure ruptures the diaphragm and permits foam to enter the tank. (Continued)

50

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it's the **only**
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**AN ABSOLUTELY
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Converted from old style

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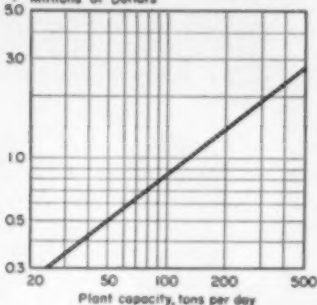


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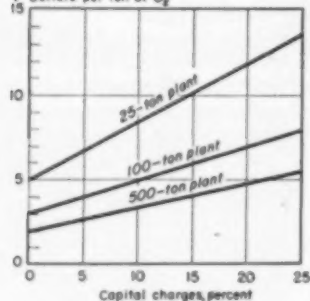
PLANT COST

Millions of Dollars



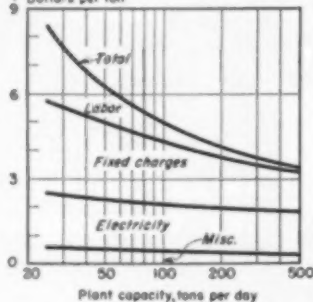
CAPITAL COST

Dollars per ton of O_2



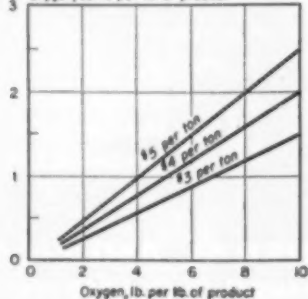
PRODUCTION COST

Dollars per ton



USE COST

Oxygen, cents per lb. of product



What Price Tonnage Oxygen?

Interest in oxygen is higher than ever. Recent design improvements in the Linde-Fraenkl process now make its tonnage oxygen cheaper than ever.

Latest news in a newsworthy field—tonnage oxygen—hinges around the modern Linde-Fraenkl process.

► Chemical Plants Div. of Blaw-Knox Construction Co., Pittsburgh, has just made an agreement with Gesellschaft fuer Linde's Eismaschinen A. G. to erect plants in the U. S. for all types of low-temperature gas separations, including oxygen by the Linde-Fraenkl process.

► Six new Linde-Fraenkl units will soon go up in Africa for South African Coal, Oil & Gas Corp., Ltd. They'll be used in the world's first modern, commercial gasoline-from-coal synthesis plant. Three 190-ton units are also now going up in Holland—to be used, probably, in the oxidation of hydrocarbons.

► The chemical, gas producing and steel industries of this country are showing keen interest in the process; it's not farfetched to say that the chemical industry will probably soon put in modern Linde-Fraenkl units to make tonnage oxygen for the partial oxidation of natural gases (to acetylene, for example).

► Meanwhile, recent refinements in the Linde-Fraenkl design have cut down power needs. This (with low investment and maintenance costs) allows the units to make tonnage oxygen at minimum cost, say Blaw-Knox engineers.

The Linde-Fraenkl process—similar in many ways to other processes now in use in the U. S.—continues to use the Linde double column. It has no auxiliary refrigeration cycle but gets its refrigeration needs from process streams. No plants using this modern cycle have been put up in this country.

The regenerators, simple packed vessels used for heat exchange between incoming air and product streams, concentrate a large amount of heat exchange surface in a given volume—thus minimizing investment over reversing exchangers. They also give a close warm-end temperature approach between the entering air and oxygen and nitrogen product streams—thus reducing power needs.

A new regenerator packing developed by Linde is cheaper than the metallic packing previously used. It also allows longer intervals between switching.

Plates in the Linde double column are designed for close spacing that (1) keeps down the height of the column, (2) reduces cold losses to the surrounding air. Yet they allow a maximum amount of air to be expanded into the upper column, do away with any need for an auxiliary refrigeration cycle in all but the smallest plants.

Linde-Fraenkl units are flexible, can be designed for oxygen purities from 70-99 percent. A plant designed to make 95 percent oxygen can operate economically to produce any purity between 80-98 percent. High-purity nitrogen streams can be produced with little effect on investment, power consumption and operating costs.

Maintenance costs, always within moderate limits, have been whittled down to 1-1.5 percent of the plant investment.

PLANT COST

Cost of Linde-Fraenkl plants (turn-key basis) varies with capacity (see cut). Costs range from \$300,000 for a 25-ton-per-day unit to \$2.6 million for a 500-ton plant. Capacity is on the basis of a 95 percent oxygen product.

A level plot has been assumed with all necessary utilities brought to the edge of the plant. Provision is made for installing and housing all equipment.

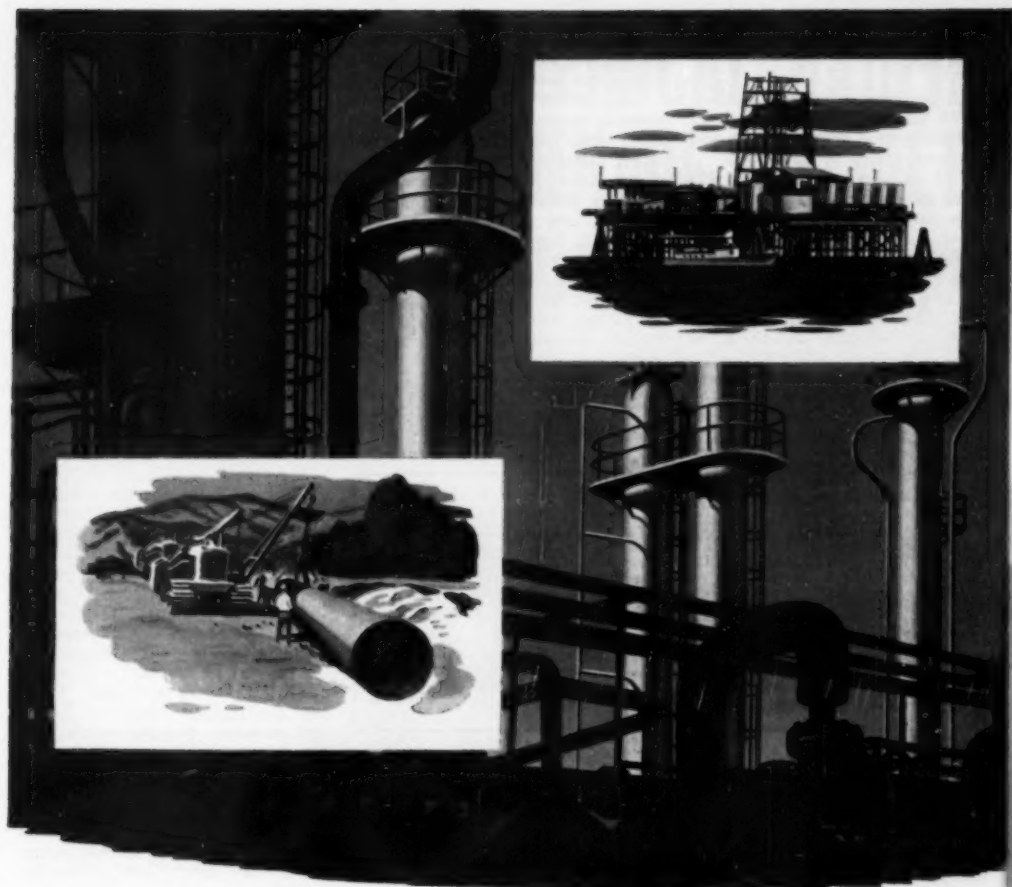
PRODUCTION COST

Production costs of 95 percent oxygen vary from \$8.45 per ton in a 25-ton-per-day plant to \$3.30 in a 500-ton unit (see cuts).

In the production cost breakdown labor is taken as two men per shift at \$1.40 per man-hour. Fixed charges represent 10 percent of the plant cost. Electricity is charged at 0.5 c. per kwh. Maintenance and supplies (under miscellaneous) represent 1.5 percent of the plant cost while water is calculated at 1.0 c. per 1,000 gal.

While labor means little in large plants, it is a major cost item in small units. It accounts for 31.9 percent of the production cost for a 25-ton plant, only 3.9 percent for a 500-ton unit.

If power is 1.0 c. per kwh. instead
(Continued)



The Petroleum Industry...and *Brown & Root*

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of 0.5 c., the total cost of producing 95 percent oxygen will go up 22.1 percent for a 25-ton plant and 43.7 percent for a 500-ton plant.

A 25-ton unit requires about 495 hp.-hr. of power per ton, 50-250 ton plants roughly 450 hp.-hr., and 300-500 ton units about 390 hp.-hr. per ton of 95 percent oxygen. Virtually all of this power goes into air compression.

Reciprocating compressors (about 77 percent efficiency on air at 80 deg. F., 78 percent relative humidity and 14.4 psia.) are used for plants with capacities up to 100 tons a day. Between 100-200 tons, an economic balance must be made to determine

whether reciprocating or centrifugal compressors are preferable.

Units of 200-300 tons a day will probably continue to use centrifugal compressors (efficiency about 71 percent). Axial flow compressors (efficiency about 79 percent) are preferred for plants of 300-500 tons.

If the fixed charge of 10 percent is doubled, oxygen cost goes up 39.0 percent for a 25-ton plant and 43.1 percent for a 500-ton unit. After the investment for a 500-ton plant is completely written off, 95 percent oxygen will cost only \$1.90 a ton to make.

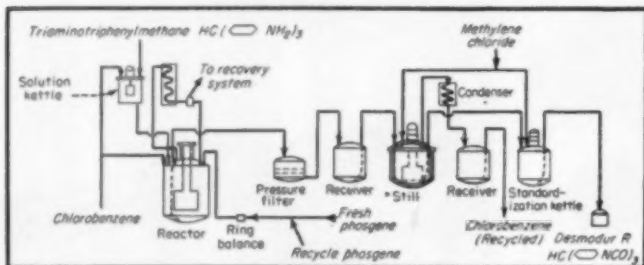
USE COST

If 6 lb. of O_2 is used per pound of acetylene made by the partial ox-

idation of methane, then the oxygen cost would be between 0.9-1.5 c. per lb. of acetylene (see cut). These figures are for 95 percent oxygen at \$3 and \$5 per ton.

In gas production, with 95 percent oxygen at \$3 per ton the cost will be between 1-4 c. per 1,000 std. cu. ft. of gas made. For Lurgi pressure gasification of coal, the oxygen would cost 1.5-2 c. per 1,000 cu. ft. For a gas producer, the amount would be roughly 3-4 c.

If 600 cu. ft. of oxygen are used for a ton of open-hearth steel, then the cost would be 7.6-12.6 c. per ton of steel. This may be more than counterbalanced by fuel savings which are obtainable in the open-hearth operations.



MAKING ISOCYANATES calls for close control of ticklish phosgene reaction.

Pace Setter in Isocyanates

Picking up where the Germans left off, Monsanto has pushed these versatile compounds through to widespread and fast-growing commercial applications. Here's how.

Isocyanates, comparative newcomers on the U.S. industrial chemical scene, are fast catching on. Ten years ago none were produced in the United States. Today, an estimated 140,000 lb. a year of all types are produced, about half for military applications. Monsanto pioneered production, followed in short order by Du Pont and Hooker. Major applications: water-repellent agents for textiles, formation of foamed resins, modified drying oils, adhesives, herbicides and pharmaceuticals.

Monsanto was first to begin production of isocyanates about five years ago. Octadecyl isocyanate led off since it reacts mole for mole with ethylene imine to produce N-octadecyl-N'-ethylene urea, which in aqueous emulsion imparts water repellency to textiles. Next, Monsanto offered m-tolylene diisocyanate, biggest volume isocyanate the Germans had produced; it's used in formation of foamed res-

ins. In addition, Monsanto now makes p,p'-diisocyanato diphenyl methane, which combines with alkyds to form bonding adhesives; phenyl isocyanate (potentially the lowest in cost) for use as a drying agent and in the production of the herbicide isopropyl N-phenyl carbamate; and ethyl isocyanate, used in pharmaceuticals.

Meantime, Du Pont in November 1946 began offering research quantities of a 50 percent solution of hexamethylene diisocyanate in o-dichlorobenzene and a 75 percent solution of tolylene 2,4-diisocyanate in o-dichlorobenzene. Hooker Electrochemical Co. in December 1947 made available phenyl isocyanate.

How did Monsanto get into isocyanates? Mostly, they were war babies. First, the National Defense Research Committee in 1944 handed the company a project that called for their production. In May of that same year Monsanto began building

a phosgene plant for the Chemical Warfare Service. The plant started operating in February 1945. It utilized carbon monoxide from the electrothermal reduction of phosphorus at the Columbia, Tenn., plant of Monsanto. Rated at 20 tons per day of phosgene, the plant operated as high as 40 tons. So Monsanto had the capacity for making the phosgene needed to produce isocyanates. Then, after the Germans surrendered, British and American technical intelligence teams uncovered considerable industrial activity in the manufacture and use of isocyanates in Germany. With this windfall of German know-how, plus its own wartime experience in production of phosgene and isocyanates, the entry into isocyanates looked like a natural to Monsanto.

First step was to set up two pilot plants, one for producing isocyanates in the liquid phase, using a solvent such as o-dichlorobenzene, and the other for making them in the vapor phase, without a solvent. In the first plant octadecyl isocyanate and m-tolylene diisocyanate were made; in the second, phenyl isocyanate, and later, ethyl isocyanate. Later, when demand outstripped capacity of the first plant, a separate plant had to be set up for the tolylene diisocyanate.

Monsanto engineers soon improved upon the German processes, making them more efficient. Just how is still hush-hush. Even so, the basic processes are still much the same as the Germans used for making such products as Desmodur R, $HC(C_6H_5)_3NCO$, a typical triisocyanate.

Here's how it's made. In a lead-lined pot, 250 kg. of triaminotriphenylmethane is dissolved in 900 kg. of chlorobenzene. This suspension is added, over 3 to 4 hr., to a solution of (Continued)

..... SOLVING CHEMICAL HAULING PROBLEMS IS A FRUEHAUF SPECIALTY!



LIQUID LATEX — Capacity 3250 gals. single compartment. 2 inches of rock-wool insulation, plus Steel jacket, over a 60" inside diameter tank. Safe working pressure 50 lb. per sq. inch.

LET FRUEHAUF SOLVE YOUR CHEMICAL HAULING PROBLEMS TOO!

WHEREVER chemicals are moved from one place to another, you'll see Fruehauf Trailers. Fruehauf's are designed to a liquid hauler's needs. They're light in weight yet extra sturdy, with feature after feature for making the job easier . . . faster . . . safer.

Constant contact with the chemical industry by Fruehauf field men keeps Fruehauf always ahead with the latest in engineering, in design and product development. Special needs or unusual problems are quickly solved by Fruehauf. Fruehauf production facilities assure prompt delivery with a minimum of waiting.

Ask the nation's leading operators about Fruehauf Trailers. They'll tell you—"They're the best built Tank-Trailers on the road today!"



A catalog of Fruehauf Tank-Trailers, with both standard units and "specials" fully described and illustrated, is available free upon request. It contains a great deal of valuable information for every Tank-Trailer user. Write *Fruehauf Trailer Co., 10964 Harper, Detroit 32, Michigan.*

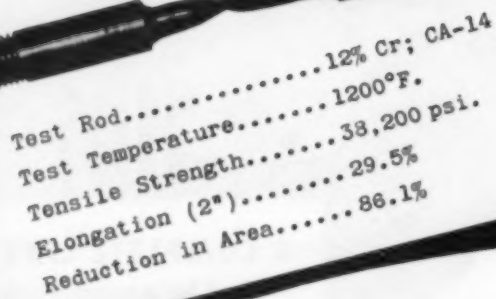
A COMPLETE LINE

Fruehauf has a complete line of Tank-Trailers for most every liquid hauling need, most of them "standards" in the line. If you require a "special", Fruehauf will design it to your needs, then follow through with its manufacture. This complete service "pays off" with a unit that's built right to last longer, perform better . . . with a nation-wide service organization to keep Trailers operating at top efficiency.

FRUEHAUF *Trailers*

"ENGINEERED TRANSPORTATION"

DURALOY



tions to a new contact sulphuric acid process and another for extraction of sulphur from low-grade ores; Penn for significant contributions to the frozen food industry, particularly frozen citrus concentrates.

Forbath was nominated by Maj. Gen. William N. Porter, Chemical Construction's president; Penn by Archie J. Weith, member of the board of directors of Minute Maid Corp.

Blase was nominated by Dr. Wilbur A. Lazier, Pfizer's director of chemical research and development, who received a certificate of sponsorship at the presentation dinner.

Presentations were made by Sidney D. Kirkpatrick, editorial director of both *Chemical Engineering* and *Chemical Week*, who served as chairman of the board of judges. Other judges were William Bowman, Jefferson Chemical Co.; Dr. Donald F. Othmer, head of the department of engineering at Polytechnic Institute of Brooklyn; Robert L. Taylor, executive vice president of the Manufacturing Chemists' Association; Zola G. Deutsch, consultant; and Dr. H. B. H. Cooper, Calco Division, American Cyanamid Co.

(Continued)

CONVENTION CALENDAR

American Pharmaceutical Association, Statler Hotel, Buffalo, August 26-31.

International Congress of Pure & Applied Chemistry, New York, September 9-11.

American Institute of Chemical Engineers, regional meeting, Sheraton Hotel, Rochester, N. Y., September 16-19.

Drug, Chemical & Allied Trades Section, New York Board of Trade, annual meeting, Shawnee-on-Delaware, Pa., September 20-22.

World Metallurgical Congress, in conjunction with National Metal Congress and National Metal Exposition, Detroit, October 15-19.

American Association of Textile Chemists & Colorists, annual meeting, Statler Hotel, New York, October 17-19.

Association of Consulting Chemists & Chemical Engineers, annual meeting, Shelburne Hotel, New York, October 23.

National Paint, Varnish & Lacquer Association, Chalfonte-Haddon Hall, Atlantic City, October 29-31.

Federation of Paint & Varnish Production Clubs, annual meeting, Chalfonte-Haddon Hall, Atlantic City, November 1-3.

American Petroleum Institute, annual meeting, Chicago, November 5-8.

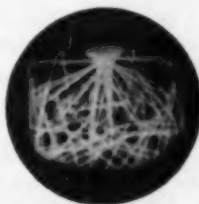
Chemical Specialties Manufacturers Association, annual meeting, Mayflower Hotel, Washington, D. C., December 2-4.

American Institute of Chemical Engineers, annual meeting, Chalfonte-Haddon Hall, December 2-5.



Something Different in Mixing Action!

... an action that may give you the better mixing you must have



Effect produced by repetitive photographs of model of the mixer arranged to combine whirling action of the mixing arm with rotation of can. Note how thoroughly the entire space occupied by the batch is covered by the agitator.

Combine the unique folding-in action of the angular mixing arm with the rotational movement of the change can and its contents and you get unusual mixing action. One section of the arm, as it rotates, passes close to the bottom driving the materials to the top and when it reaches the top forces material downward again. Another section of the mixing arm sweeps the sides of the can with a rotational movement. The third section cuts through the charge in the can, with an eccentric like motion. While all this is going on, the can itself is rotating on the power driven turntable, resulting in the elimination of any dead spots or localized whirlpools. Tests and production results on many different products bear out this point. Mixing is thorough and fast.

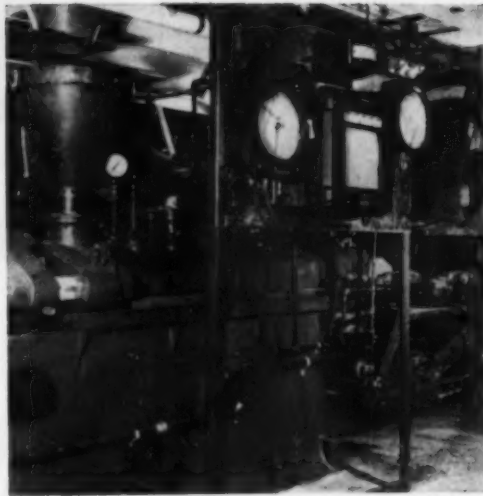
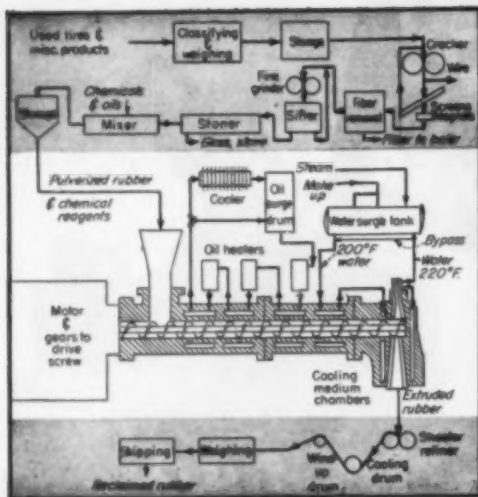
The Troy Angular Mixer is available in two production sizes: 40 and 60 gallons. Several sizes of motors are available, the selection depending upon the nature of materials being mixed: light motors for liquids and semi-pastes; larger up to very heavy motors for heavy and extremely viscous materials. The design is such that when mixing is completed, the whole mixing mechanism can be tilted back to permit removal of the can.



Process Machinery Division

TROY ENGINE & MACHINE CO.

3002 RAILROAD AVENUE • TROY, PENNSYLVANIA



How to Slash Devulcanizing Time

Chemical treatment in novel reclaimator is nub of first continuous process for reclaiming scrap rubber. Oxidoplasticization agents cut time from hours to minutes.

A new continuous method for processing reclaimed rubber has just been put into commercial operation by U. S. Rubber Reclaiming Co. at its new \$2.5 million plant at Cheektowaga, N. Y. A battery of reclaimators, or modified 12-in. screw extruders, turns out about 120,000 lb. per day.

This new method for devulcanizing used rubber products slashes total transit time through the plant from three days to one hour. Actual processing time has been cut from 10 hr. to a few minutes.

This revolutionary new concept in devulcanizing scrap rubber at last puts reclaiming on a simple and continuous basis. With one pass through the reclaimator the ground fiber-free scrap becomes devulcanized. The conventional digester process requires 24 steps to convert an old tire into a slab of reclaimed rubber. The new process takes only 14 steps. Washing and drying are out altogether; straining is eliminated by magnetic separation, with stoners removing non-magnetic material.

It's the use of oxido-plasticization agents that cuts the devulcanization time to minutes. Among such agents that give particularly good results are aliphatic and aromatic mercaptans; aliphatic and aromatic monosulphides;

aliphatic and aromatic disulphides; unsaturated hydrocarbons such as terpenes, especially terpinolene; unsaturated ketones, including phorone; a butyraldehyde-aniline condensation product; and various unsaturated and other nitrogen compounds and sulphur compounds.

The process permits use of a dry mix, just as in the pan process. The mix is extruded in the 12-in. reclaimators. High production is achieved at low power consumption. Each reclaimator has a 300-hp. synchronous motor. Operating temperatures of 275-350 deg. F. are much lower than the 350-400 deg. F. temperatures in the older reclaiming processes. Temperatures are automatically controlled.

In addition, equipment and labor requirements are greatly reduced. Another advantage: less fire hazard.

Other features of the new plant are recovery of byproduct fabric, bead wire and fine-mesh rubber crumb, which can be sifted from the main production of ground crumb.

Major credit for development of this new devulcanizing process goes to Research Chemist Edward F. Sverdrup, who, together with U. S. Rubber Reclaiming engineers, developed the treatment of powdered rubber with chemical reagents in the new reclaimator.

Old auto, bus and truck tires are sorted according to size and weighed. Unlike older processes, this one doesn't require sorting according to composition—natural, retread or synthetic. However, sortings on the basis of composition are sometimes made for special types of reclaim.

Tires are first cracked on a horizontal corrugated roll mill. This tears the rubber apart and separates it from the bead wire, most of which is picked off the cracker belt by hand. Output is screened, and larger pieces of rubber are recycled to the cracker.

Small pieces, cracked to $\frac{1}{4}$ -in. size, are passed over a magnetic separator to remove steel bead wire and other metal objects, and then moved to temporary storage. From storage, the scrap goes to a mechanical fiber removing system. This consists of attrition mills, air flotation devices, beaters and sizing screens. Here cotton and rayon cords in the cracked scrap are removed.

Fiber-free scrap is next passed through a mill roll or fine grinder, where the final reduction of the crumb to 20 mesh takes place. Sifted crumb then passes over a stoner that removes such non-magnetic particles as glass, stone, brass and sand.

Stoned particles of scrap rubber are automatically fed to a uniform controlled rate to a double screw mixer. The oxido-plasticization agent, together with softening oils, is fed continuously, by proportioning pump, to the mixer. Mixed crumb is then conveyed to a surge bin over the reclaimator.

A variable speed rotary valve main-
(Continued)

Here's one **CERTAIN** way you
can increase the capacity of your
air-cooled condensers

Install **WOLVERINE TRUFIN***

You can multiply the capacity of your air-cooled condensers at least twice—sometimes even more—than that of plain tube units of the same size. And, for increased efficiency, the use of Wolverine Trufin greatly increases the condensing surface area in the same amount of space!

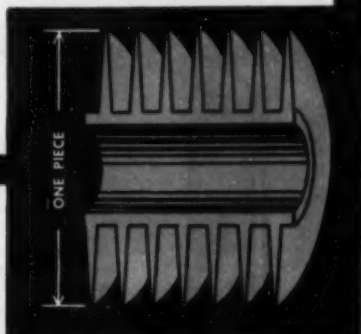
Operational troubles are minimized, too, because the fins of Trufin are extruded from the tube itself. With the fins integral to the tube, they easily stand vibrations and extreme temperature changes.

Yes, Trufin is the answer to many condensing tube problems where you need the utmost in efficient performance. **WOLVERINE TUBE DIVISION**, Calumet & Hecla Consolidated Copper Company, Incorporated, Manufacturers of Seamless, Non-Ferrous Tubing, 1427 CENTRAL AVENUE, DETROIT 9, MICHIGAN.

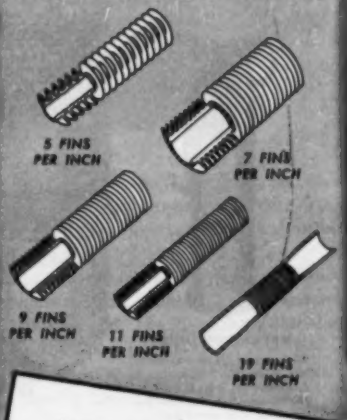
*Reg. U. S. Pat. Off.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ont.

Wolverine Condenser Tubes stocked by Butler Industries, Inc., 355 South Fourth Street, Beaumont, Texas. Tel.: Beaumont 5-2351.



Trufin is available in many sizes, alloys, and fin spacings in both single metal and bi-metal tubes.



A request on your stationery will bring you Bulletin giving helpful information regarding the use of finned tube in air-cooled condensers. Would you like a copy?



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Sales Offices in Principal Cities

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Get 'Em from Your Jobber!

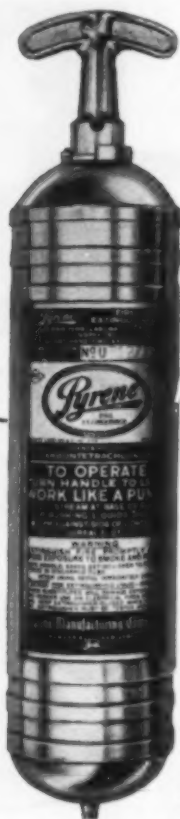
You can be sure your Pyrene® jobber will recommend the right extinguishers for your fire hazards—because there's a Pyrene for every fire hazard! Standardize on Pyrene, a symbol of quality since 1907.

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CARTRIDGE-OPERATED

New stainless steel shell—new low price. No annual recharging; no acid. For fire in wood, paper, textiles. 2½ gal. size.



AIR FOAM

Couple pump to hose line. Every 10 gals. of water and 1 gal. of Pyrene Foam Compound yield 200 gals. of foam! For flammable liquids and ordinary combustibles.



VAPORIZING LIQUID

World's best all-purpose extinguishers. Safe on electrical fires, effective on flammable liquid fires. 2 qt., 1 gal. (above) pressure types. 1 qt. (large illustration) and ½ qt. pump types.



CHEMICAL FOAM

2½ gal. size produces about 22 gals. of fast-acting foam. Ideal for flammable liquid and ordinary combustible hazards. Seamless copper or stainless steel shell. (Pyrene Soda-Acid also available in stainless steel or seamless copper.)

And other extinguishers. Also manual and automatic fire-fighting systems.

**There's a PYRENE
for Every Fire Hazard**



PYRENE MANUFACTURING COMPANY

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Affiliated with C-O-Two Fire Equipment Co.

NEWS, CONT. . .

tains a continuous uniform feed to the reclaimator. In the reclaimator, the finely ground scrap plus chemicals is compressed by a continuously moving screw. It's heated rapidly to about 350 deg. F. and worked mechanically. Devulcanization occurs. Then the rubber is cooled rapidly and goes to the sheeting refiner. Thence it passes over a cooling drum and goes to the wind-up drum. When the right slab thickness is reached, the sheet is cut from the wind-up drum, dusted with whitening, and readied for shipping.

The reclaimator is a long horizontal cylinder. Chambers around the space through which the rubber passes provide passage for heating and cooling medium. The outlet head is also provided with a similar arrangement. To maintain the proper temperatures, the temperature of the oil-cooled feed section is controlled independently of the temperature of the water-cooled outlet end.

Liquid Oxygen Plants Authorized by DPA

Two producers have been authorized by the Defense Production Administration to go ahead with facilities for production of liquid oxygen.

Union Carbide & Carbon Corp. applied for a certificate on a \$4,250,000 plant at Ashtabula, Ohio, is eligible for \$4,168,000, with a 65 percent allowance. Carbide was also granted authorization on a \$7,964,580 plant at East Chicago, Ind., at a 55 percent writeoff.

Air Reduction Co. submitted an application on a \$5,648,582 plant at Butler, Pa., is eligible for \$5,531,252, and gets fast amortization on 65 percent.

United Dye Will Take On Others' Research Project

Its facilities and experience will be offered by the 153-year-old United Dye & Chemical Corp. to companies and individuals who have chemical problems or who need assistance in developing practical chemical ideas.

"... many individuals and small companies have practical chemical products and processes but lack the research equipment, the concentration of technical personnel, and the know-how to develop their ideas to commercial status," explains President David S. Fischman of United.

"We have the laboratories, the research and testing equipment... the trained technical personnel and a background of 153 years in the chemical industry. We believe these facilities

ties and personnel should be made available, and that is what we are doing with this new program."

United has set up a research and development service that will evaluate ideas, products and processes. If it appears that United's facilities and background can be of value, development of likely projects will then be undertaken on a mutual basis.

United Dye & Chemical has long experience in organics, particularly in vegetable and synthetic dyes and pigments. Through a subsidiary, it's preparing to enter the ethical and proprietary drug field. Plants operated by the company's subsidiaries are in Belleville, N. J., and Chester, Pa., and in many foreign countries.

Georgia Site Picked for New Paperboard Plant

Another multi-million-dollar paperboard plant will be built in Georgia. Mead Corp. will put it up 10 miles from Rome on the Coosa River. The \$21 million plant will be a duplicate of the Macon Kraft Co. plant, which is operated by Mead and the Inland Container Corp.

A certificate of necessity has been obtained, but construction hasn't started yet.

The plant site consists of 700 acres. Mead recently purchased 40,000 acres of land near Allatoona Dam, about 40 miles east of Rome, to use for forestry purposes.

Borden Builds Southeast's First Formaldehyde Plant

First formaldehyde plant in the Southeast will be built by Borden Co. on the outskirts of Demopolis, Ala. It will also produce liquid urea resin.

Construction on the outdoor type of distillation plant, which will cover about five of the 20 acres, will begin soon. Completion is scheduled for the first part of 1952.

The Demopolis plant will be geared to produce about 1.5 million pounds of formaldehyde and about 2 million pounds of liquid urea resin per month during the first year of operation.

Entire output of formaldehyde at Demopolis will be used by Borden, part of it for making resin right there and the rest at Borden's other southern plant at Kernersville, N. C., which makes liquid urea resin glue for the South's furniture industry.

Formaldehyde is made by oxidation of methanol, which in turn is made from natural gas. Formaldehyde made at Demopolis will be combined with urea shipped in from the Southeast to produce the liquid urea resins.

(Continued)

HELICOID Chemical Gage

Standard dials: 0-15, 30, 60, 100, 150, 200, 300, 400, 500, 600, 800, 1000, 1500, 2000, 3000. Also 0-30" vac., 15 and vac., 30 and vac., 60 and vac.

Removable bottom part and
Diaphragm plug available for

Bronze
Cast Iron
Lead Coated Iron
Steel
Stainless Steel (316)
Monel
Hastelloy B
Hastelloy C
Dural (24 S-T)
Carpenter No. 20 (Duramet)
Nickel
Everdur
Hard Rubber

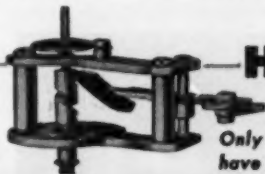


Here's a chemical gage for any pressure to 3,000 p.s.i. and also for vacuum or compound ranges, and temperatures to 300° F. Particularly suitable for chemicals and other viscous liquids that either corrode or clog a Bourdon tube gage.

One feature of this Chemical Gage is that the diaphragm is made of "TEFLON" which is flexible and resists practically all corrosive chemicals. No fragile metal foils are used. The diaphragm chamber is supplied of any metal most suitable for the service.

Available in the following dial sizes: 4½", 6", or 8½". 1" female N.P.T. bottom connection. Flanged connection also supplied.

ACCO

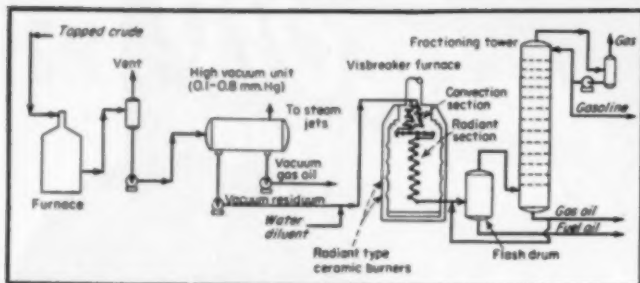


HELICOID

Only Helicoid Pressure Gages
have the Helicoid Movement

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE COMPANY, INC.
Bridgeport 2, Connecticut





HIGH vacuum distillation and visbreaking units at Phillips' Borger refinery.

Two New Petroleum Advances

Now super high vacuum distillations and mild thermal cracking of high vacuum residuum approach commercial reality. They'll mean more gasoline, less fuel oil from crude.

Two new successful techniques in petroleum processing are now revealed by J. G. Allen* of Phillips Petroleum Co.: (1) high vacuum distillations that operate at absolute pressures of 0.1-0.8 mm. Hg and (2) the thermal cracking or visbreaking of a highly viscous vacuum residuum using a radiant heater new to the petroleum field.

The high vacuum distillation unit, recently put into operation, is unconventional and novel in its construction and operation. Results are already very promising although the unit is considered as still under development.

* With D. M. Little and P. M. Waddill at the recent meeting of the American Institute of Chemical Engineers in Kansas City.

Visbreaking of high vacuum residuum in a radiant-type heater is now proved to be both technically and economically feasible by a commercial unit in Phillips' Borger, Tex., refinery. Probably no one in the refining industry, either past or present, has commercially visbroken a residuum so viscous and so completely stripped of gas oil as Phillips is now doing.

These two chemical engineering developments may well spark a trend in petroleum processing that will help upgrade the value of the nation's crude oil resources by increasing the yields of gasoline and distillate at the expense of fuel oil.

In recent years chemical engineers

in petroleum refineries have focused a great deal of their attention on how to make better use of the heavier fractions of crude oil. This has come about, in great part, from the instability of the fuel oil market, the ever-growing demand for gasoline and the efficient use of high-boiling feedstocks in catalytic cracking units.

TOWARD SUPER VACUUM

High-vacuum distillation is one of the best—and most economic—ways to separate heavy oil fractions. Just as two decades ago the refiner was pushing operating pressures from 40 to 400 atm. to convert light hydrocarbon gases to more valuable products by polymerization and absorption, so today he is pushing vacuum operations from 0.1 to 0.01 or even 0.001 atm. to recover more of the high-boiling hydrocarbons now used chiefly for their low-value Btu. content.

For over a year Phillips has operated vacuum units at high loads and absolute pressures in the range of 6-14 mm. Hg. Now it has put into operation a unit operating in the range of 0.1-0.8 mm.

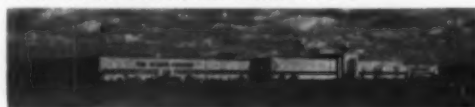
Enough information is already available on the performance of this unit, still under development, for Phillips to predict that within a few years vacuum distillations in the petroleum industry will operate at absolute pressures of 0.1 mm. or lower.

VISBREAKING THE RESIDUUM

This use of high vacuum to recover heavy hydrocarbons from crude oil gives the refiner another problem: what to do with the high viscosity vac-

(Continued)

New Pharmaceutical Plant . . .



. . . AT KALAMAZOO, said to be the nation's most modern



. . . DOUBLES PRODUCTION CAPACITY of drugs made by Upjohn Co. Here is a battery of 5,000-gal. fermentation tanks in the special antibiotics building. The new plant is lo-

cated on a 1,500-acre site. It has 33 acres of floor space under one roof—a consolidation of operations that formerly occupied 30 buildings.

Upjohn engineers collaborated with Austin Co., which built the plant, to work out a design flexible enough to allow production of Upjohn's present 700 products and yet leave plenty of space and facilities for future expansions.

The new Kalamazoo facilities are set up for continuous flow operations: raw materials enter one side of the huge building, move through the central processing area to a packaging center, finally go as finished products to a warehouse area on the far side.

Administrative offices and the research department remain at Upjohn's downtown site in Kalamazoo. The most advanced methods and tools of research have been installed in the laboratories. A two-million-electron-volt Van de Graaff accelerator, the first purchased by an American industrial firm, is used experimentally to sterilize drugs.

Upjohn is a major producer of antibiotics, hormones (including the adrenal cortical extracts), sulfa preparations, blood plasma substitutes, vitamins (up to 4 million capsules a day) and other drugs and nutritional supplements. The company has some 3,500 employees.

1...2...3...4... 5...6...7...8 *Big Reasons*

why the
B & G 1522 Hydro-Flo PUMP
will better satisfy
your pumping needs

Plant engineers and maintenance men are astonished at the performance of the B & G 1522 Pump... because this unit licks the pumping jobs which usually cause trouble. For these reasons—

First: Leak-proof Mechanical Seal—ends stuffing box troubles.

Second: Spring-type flexible coupling—contributes to unusually quiet operation.

Third: Hydraulically balanced impeller.

Fourth: Easily serviced. Removal of a few bolts permits separation into three parts.

Fifth: Interchangeable parts. The bearing bracket sub-assembly, including shaft and sleeve bearings, is manufactured to close tolerances and is interchangeable in all 1522 Pumps.

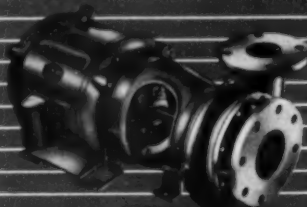
Sixth: Shaft alignment maintained by oil-lubricated, high-grade bronze sleeve bearings.

Seventh: Standard motors—easily obtainable from motor manufacturer's stocks.

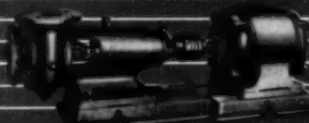
Eighth: With all these features B & G 1522 Pumps are competitively priced!

B & G Series 1522 Pumps are available in all-iron, bronze-fitted, all-bronze and stainless steel units. Capacities to 130 GPM—heads to 115 ft. Write for catalog CY-350.

**B & G
SERIES 1522
CENTRIFUGAL
PUMP**



**B & G
SERIES 1531
PUMP**
Leak-proof Mechanical Seal.
Capacities to
1200 GPM—
heads to 320 ft.



**B & G
SERIES 1510-13
PUMP**
Flexible coupled. Capacities
to 1200 GPM—
heads to 320 ft.



BELL & GOSSETT

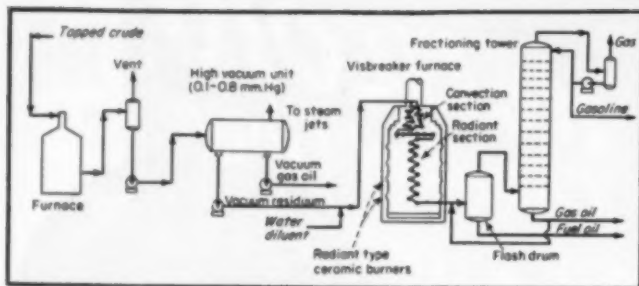
C O M P A N Y

Dept. CC-14, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

*Reg. U. S. Pat. Off.

HEAT EXCHANGERS—FORCED HOT WATER HEATING SYSTEMS—WATER HEATERS—REFRIGERATION EQUIPMENT



HIGH vacuum distillation and visbreaking units at Phillips' Borger refinery.

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High-vacuum distillation is one of the best—and most economic—ways to separate heavy oil fractions. Just as two decades ago the refiner was pushing operating pressures from 40 to 400 atm. to convert light hydrocarbon gases to more valuable products by polymerization and absorption, so today he is pushing vacuum operations from 0.1 to 0.01 or even 0.001 atm. to recover more of the high-boiling hydrocarbons now used chiefly for their low-value Btu. content.

For over a year Phillips has operated vacuum units at high loads and absolute pressures in the range of 6-14 mm. Hg. Now it has put into operation a unit operating in the range of 0.1-0.8 mm.

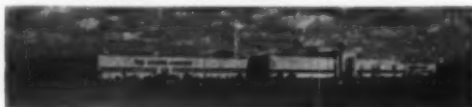
Enough information is already available on the performance of this unit, still under development, for Phillips to predict that within a few years vacuum distillations in the petroleum industry will operate at absolute pressures of 0.1 mm. or lower.

VISBREAKING THE RESIDUUM

This use of high vacuum to recover heavy hydrocarbons from crude oil gives the refiner another problem: what to do with the high viscosity vac-

(Continued)

New Pharmaceutical Plant . . .



. . . AT KALAMAZOO, said to be the nation's most modern



. . . DOUBLES PRODUCTION CAPACITY of drugs made by Upjohn Co. Here is a battery of 5,000-gal. fermentation tanks in the special antibiotics building. The new plant is lo-

cated on a 1,500-acre site. It has 33 acres of floor space under one roof—a consolidation of operations that formerly occupied 30 buildings.

Upjohn engineers collaborated with Austin Co., which built the plant, to work out a design flexible enough to allow production of Upjohn's present 700 products and yet leave plenty of space and facilities for future expansions.

The new Kalamazoo facilities are set up for continuous flow operations: raw materials enter one side of the huge building, move through the central processing area to a packaging center, finally go as finished products to a warehouse area on the far side.

Administrative offices and the research department remain at Upjohn's downtown site in Kalamazoo. The most advanced methods and tools of research have been installed in the laboratories. A two-million-electron-volt Van de Graaff accelerator, the first purchased by an American industrial firm, is used experimentally to sterilize drugs.

Upjohn is a major producer of antibiotics, hormones (including the adrenal cortical extracts), sulfa preparations, blood plasma substitutes, vitamins (up to 4 million capsules a day) and other drugs and nutritional supplements. The company has some 3,500 employees.

1...2...3...4... 5...6...7...8 *Big Reasons*

why the
B & G 1522 Hydro-Flo PUMP
will better satisfy
your pumping needs

Plant engineers and maintenance men are astonished at the performance of the B & G 1522 Pump... because this unit licks the pumping jobs which usually cause trouble. For these reasons—

First: Leak-proof Mechanical Seal—ends stuffing box troubles.

Second: Spring-type flexible coupling—contributes to unusually quiet operation.

Third: Hydraulically balanced impeller.

Fourth: Easily serviced. Removal of a few bolts permits separation into three parts.

Fifth: Interchangeable parts. The bearing bracket sub-assembly, including shaft and sleeve bearings, is manufactured to close tolerances and is interchangeable in all 1522 Pumps.

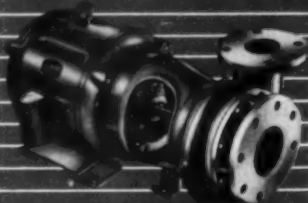
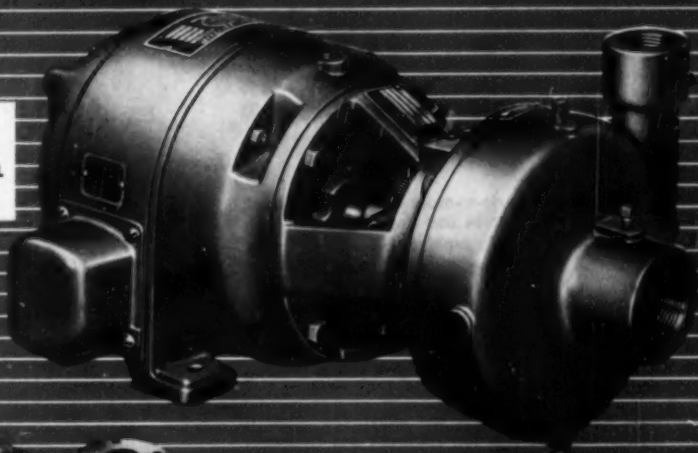
Sixth: Shaft alignment maintained by oil-lubricated, high-grade bronze sleeve bearings.

Seventh: Standard motors—easily obtainable from motor manufacturer's stocks.

Eighth: With all these features B & G 1522 Pumps are competitively priced!

B & G Series 1522 Pumps are available in all-iron, bronze-fitted, all-bronze and stainless steel units. Capacities to 130 GPM—heads to 115 ft. Write for catalog CY-350.

**B & G
SERIES 1522
CENTRIFUGAL
PUMP**



**B & G
SERIES 1531
PUMP**
Leak-proof Mechanical Seal.
Capacities to
1200 GPM—
heads to 320 ft.



**B & G
SERIES 1510-15
PUMP**
Flexible coupled. Capacities
to 1200 GPM—
heads to 320 ft.



BELL & GOSSETT

C O M P A N Y

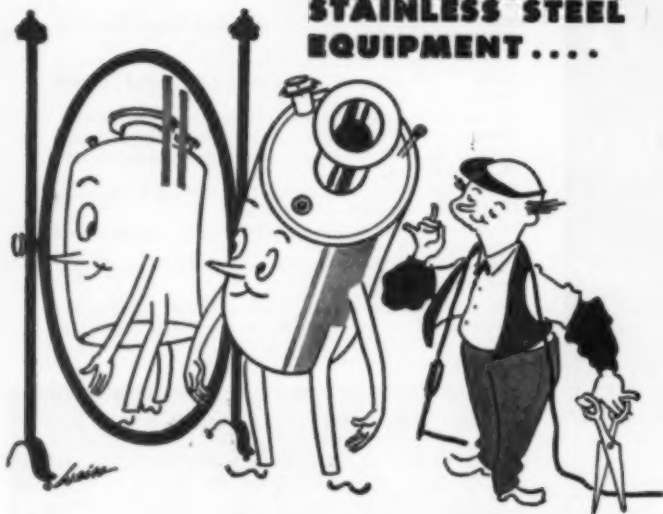
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Custom Built STAINLESS STEEL EQUIPMENT....



**...is ONLY AS GOOD AS
ITS FABRICATOR**

From the minute you decide on a made-to-order stainless steel vessel, you're in the hands of a fabricator. In fact the selection of your fabricator is generally one of your big problems.

It's more than a question of following blueprints. Stainless steel is a difficult alloy to work. It "acts up" during fabrication. In cutting, forming, welding and even in finishing, your fabricator must know how to guard the corrosion resistance and strength of the alloy. His plant must be specially equipped for working with stainless steel. The longer his experience, the more help he'll give you in building vessels that meet your requirements.

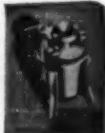
We work exclusively with stainless steel and alloys. Our plant is specially tooled to fabricate this metal. Our engineers and mechanics are particularly trained for the work. Why not consult us when you plan your next stainless steel vessel?

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Guards Alloys in Fabrication

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head will bring our
guide, "What to Look
For When You Specify
Stainless Steel for Your
Processing Equipment."



CORROSION RESISTANT PROCESSING EQUIPMENT



TANKS • KETTLES • STILL • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

NEWS, cont. . .

num residuum other than simply cutting it back to fuel oil specifications.

Here again, Phillips engineers say they now have the answer: visbreaking or mild thermal cracking of the residuum in a radiant-type heater. Result is less fuel oil, more catalytic cracking feedstocks for greater yields of gasoline and distillate.

Since stability against heating decreases as molecular size increases, Phillips' problem was not whether the vacuum residuum could be cracked by thermal treatment but whether it could be cracked without prohibitive coking in the cracking coils.

Phillips uses an updraft radiant-type heater for the commercial visbreaking furnace. The construction, operation and performance of this unit have already been described (*Chem. Eng.*, June, p. 200). This visbreaker has operated 39 days and more without a shutdown due to coking in the coils.

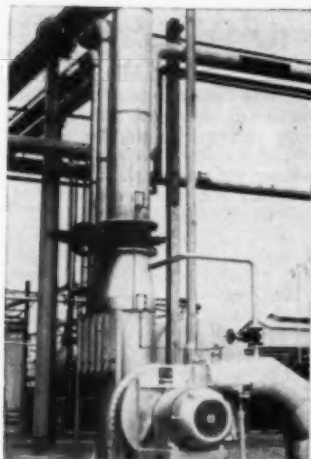
Operation of the high vacuum distillation and visbreaking units is shown above (see cut). Reduced crude is preheated, given an atmospheric flash and then charged to the high vacuum unit. Residuum from this unit is charged to the visbreaker furnace through a small surge tank.

The furnace product is quenched at once with gas oil and charged to a flash drum. Heavy residuum is sent to storage from the bottom of the flash drum; overhead vapors are charged to a bubble tower. This tower gives gas and gasoline overheads and gas oil bottoms. The gas oil is cooled and a portion cycled to the furnace outlet as quench oil; the rest is stored.

Charge to the visbreaker represents 14.1 liquid-volume (LV) percent of the crude; the product represents 10.7 LV percent of the crude (both on the basis of 300 SFS at 122 deg. F.). This 3.4 percent reduction in fuel oil would be substantial in any refinery. The injection of 1-2 percent water as diluent in the visbreaker coil charge reduces the fuel oil equivalent even more: from 10.7 to 8.5 LV percent of the crude.

Furthermore, visbreaking gives additional gas oil of low carbon residue and high aniline point, suitable as catalytic cracker feedstock. Ultimate result of visbreaking, then, is to increase the production of gasoline and distillate at the expense of fuel oil.

Economic advantage of visbreaking plus catalytic cracking over simple fuel oil blending naturally becomes less as the price of fuel oil goes up. The general breakeven point is considered to be near a fuel oil price of about \$3.70 per bbl.



Shell Puts Up New Unit To Burn Waste Gases

A new fume-burning system is now operating at the Pittsburg, Calif., plant of Shell Chemical Corp. The stainless steel unit (see cut) is expected to become a model for fume disposal units at similar plants across the country. It cost \$60,000 and can handle 7,000 cu. ft. of gases a minute.

Waste gases formerly discharged through a 65-ft. stack now go through stainless steel suction lines to a stainless centrifugal blower that sends them through an underground pipe to the boiler building. Here they are fed into the four steam-generating boilers where temperatures up to 3,000 deg. F. break down and burn the odorous materials.

Flame arresters at the boiler doors and a water-seal box outside the boiler building prevent any fires from flaring back through the system.

The new unit handles waste gases from Shell's ammonium sulphate crystallizers and dryers as well as lesser quantities of fumes from sludge tanks, oil trucks and other plant sources.

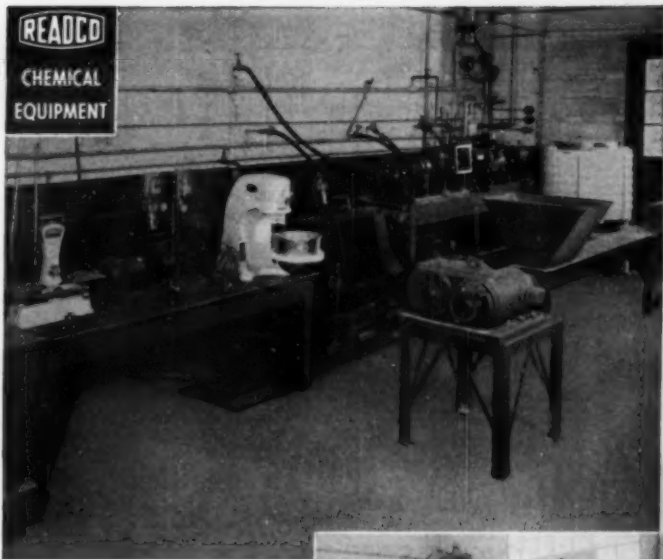
Jefferson Expanding Ethanolamine Output

Ethanolamine capacity at Port Neches, Tex., will be expanded by Jefferson Chemical Co. Construction is expected to start this month. C. F. Braun Construction Co. has the contract.

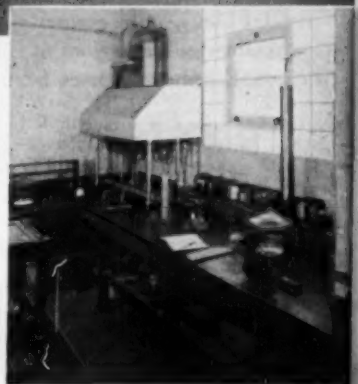
Three chemicals to be turned out by the new facilities are mono-, di- and triethanolamine. They'll be used in the manufacture of many synthetic detergents, and as a scrubbing agent for hydrogen sulphide in gases.

(Continued)

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CHEMICAL
EQUIPMENT



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Complete research facilities enable Read Standard engineers to make a thorough analysis of your special processing problems under closely simulated operating conditions—to design and manufacture the proper equipment to do your job.

Or, if you prefer, Read Standard's modern, fully equipped, mechanical and analytical laboratories will be placed at your disposal to assist you in determining the proper equipment to fit your specific needs.

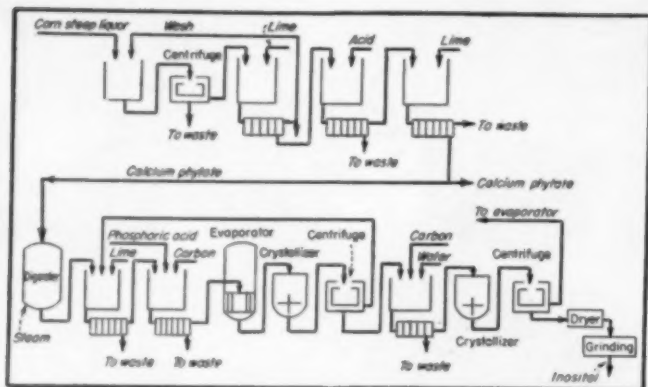
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RESEARCH—A READ STANDARD SERVICE TO THE PROCESSING INDUSTRY

FORMERLY Read Machinery Division of The Standard Stoker Company, Inc. ONLY THE NAME HAS CHANGED.

READ STANDARD
CORPORATION



COMMERCIAL PROCESS gets inositol from corn steep liquor, will . . .

Up Output Tenfold

First year's production already sold to pharmaceutical makers as Staley goes to full plant with pioneer process. Medicinal, industrial uses beckon as price tumbles.

A tenfold expansion in capacity for making inositol, potent weapon in the fight against liver cirrhosis and hardening of the arteries, has just been completed by A. E. Staley Manufacturing Co. At Decatur, Ill., the company's first commercial plant is now in operation. So great is demand, pharmaceutical makers have swamped Staley with orders; the entire first year's output is already sold.

This demand sparked Staley's decision to build a commercial plant. When the company began inositol research back in 1943, there were no active commercial processes. For seven years now, Staley has been making inositol in a small pilot plant. In that time, the price has plummeted from \$36 to \$5 a lb.

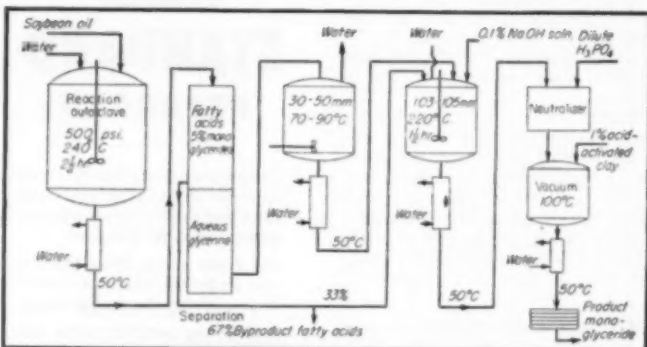
Inositol, alone or with other substances, acts as a lipotropic, or fat-splitting, agent; it reduces accumulations of fat around the liver and other organs. Research is being pushed, with encouraging results, to determine its biologic significance.

Inositol, or cyclohexanehexol, is a sugar substance and a member of the vitamin B complex. It occurs naturally in plants and animals in the tissues and fluids.

Corn steep liquor is the raw material in Staley's improved process. The 50 percent solids liquor is clarified and lime is added. Inositol hexaphosphate reacts with the calcium ion and forms a precipitate of calcium phytate. The precipitate is filtered, washed, dried and ground. One

hundred pounds of corn steep liquor yields 9 to 10 lb. of crude phytate, which may be refined and sold as calcium phytate or further converted to inositol.

Crude phytate is slurried with water, digested and hydrolyzed to inositol



NEW PROCESS can turn out a food-grade monoglyceride directly from soybean oil.

Glycerides Without Glycerine?

What would happen to monoglycerides if defense needs should really put the squeeze on glycerine? A cheap, direct process that needs no glycerine could take right over.

What's more, the new process—which produces a monoglyceride product directly from soybean oil—could probably do it as cheaply as the pres-

ent method that needs both soybean oil and glycerine. The product would be suitable for use as an emulsifier in shortenings for food products.

under pressure and at elevated temperature. Lime is added to remove insoluble calcium salts, and pH is adjusted with phosphoric acid. Decolorizing carbon is added, the solution filtered, evaporated, crystallized, centrifuged and redissolved. It is again decolorized with carbon, recrystallized, centrifuged, dried and ground.

Inositol has possible industrial uses in making blasting caps, synthetic resins, surface coatings, plastic composition bases and as a nutrient for yeast production. So far, medicinal demand has taken the entire supply. This may change as the price comes down and other producers follow Staley's example and expand output.


Benzene From Hawaii Goes To Stauffer in Nevada

First shipment of benzene from Hawaii, a consignment of 300,000 gal. for Stauffer Chemical Co., reached Los Angeles recently.

Honolulu Gas Co. gets the benzene as a byproduct of the destructive cracking of oil to gas. Crude benzene is refined at the new plant of Pacific Refiners Ltd. in the islands. Current output has been contracted for by Stauffer.

From Los Angeles, Stauffer trucks the benzene to its Henderson, Nev., plant, where it's chlorinated and used in making DDT and BHC.

Here's how you can tell the chain with SHOT-PEENED rollers...



LOOK FOR THE
DISTINGUISHING
DARKENED ROLLERS

Thousands of tiny steel balls hammer the metal—"cold work" each roller... pay off in extra fatigue life... added ability to withstand shock and impact.

...the chain that has extra fatigue life

YES, you want to be sure you get shot-peened rollers on the next roller chain you buy. Shot-peening gives rollers the extra fatigue life needed to take repeated shock and impact loads.

These chains are high in tensile strength, durable under severe loads, relatively light in weight and uniform in pitch. This accounts for their wide acceptance throughout industry for both drive and conveying purposes.

Thanks to constant research and precise manufacturing controls, every Link-Belt Precision Steel Roller Chain meets the highest standards for uniform strength. You get a positive, long-life drive—unaffected by heat, cold or moisture.

Link-Belt Roller Chain is available in single or multiple widths, in $\frac{3}{8}$ to 3 in. single and double pitch. For all the facts, call your nearest Link-Belt office.

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PRECISION STEEL ROLLER CHAIN

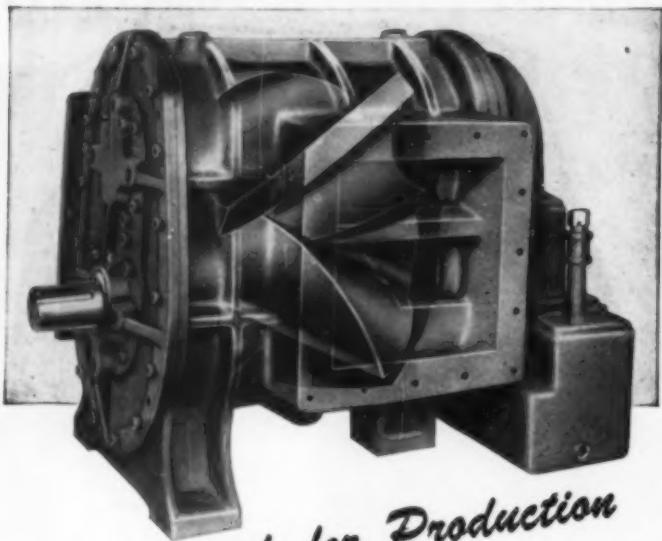


**Easier coupling
and uncoupling without
sacrificing load distribution**

Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple width chains—right on the job—is far easier. There's absolutely no sacrifice of load distribution... no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load carrying capacity across the entire width of the chain has been maintained.

LINK-BELT COMPANY: Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 53, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in principal cities. 12, 201

The **STANDARD**AIRE *Axial Flow* **BLOWER** ~



Engineered for Production

TO MEET the increasing demand for Standardaire Blowers our manufacturing facilities have progressed from custom built techniques to precision production methods for the principal components of the blower. In addition to other improvements, new manufacturing processes and equipment are now being used to generate the cycloidal form, screw type main and gate rotors on a production basis without sacrificing precision and accuracy of fit—important details in maintaining the "air screw" action feature of the Standardaire Blower.

Through this unique achievement in production engineering it is possible for Standard Stoker to offer industry a Standardaire Blower with the design features and efficiency of a custom built job at the availability of a quantity production unit.

*Consult with our engineers on how the modern design Standardaire Blower can be adapted to suit your requirements. Write
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B L O W E R - S T O K E R D I V I S I O N

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NEWS, cont. . .

The glycerine-less monoglyceride process can thus become of real importance if glycerine supplies become short or if the price of this raw material should soar (as it has been prone to do).

Laboratory work on the new method has been conducted by researchers at the Dept. of Agriculture's Northern Regional Research Laboratory in Peoria, Ill. Preliminary cost estimates indicate that the net cost of raw materials—after allowing credit for by-product fatty acids—is slightly less than that for producing monoglyceride from soybean oil and glycerine.

Hydrolysis and esterification reactions (see cut) are the heart of the new process, stated NRRL's R. E. Beal and N. H. Ludwig before a recent meeting of the American Oil Chemists' Society. Refined, bleached and deodorized soybean oil is the raw material.

This soybean oil is mixed with an equal weight of distilled water in a Type 316 stainless steel, agitated autoclave. The system is evacuated to a pressure of 3 mm. Hg and until a temperature of 40 deg. C. is reached. This removes air that tends to darken the product at higher temperatures.

The oil is then treated at about 500 psi. and 240 deg. C. for 2.5 hr. The result is 91 percent hydrolysis and a 5 percent monoglyceride content in the fatty acid layer.

After being cooled to 50 deg. the aqueous glycerine phase is removed from the fatty acid phase as the bottom layer in a separation column. The glycerine phase is then heated to 70-90 deg. under a vacuum of 30-50 mm. absolute pressure; this removes most of the water.

After cooling, a third of the fatty acid phase is added to the glycerine in an agitated autoclave. Then 0.1 percent of caustic soda (based on weight of acids) is added. The caustic seems to promote emulsification of the two layers and to act as a catalyst in the formation of monoglycerides.

The mixture is agitated and heated to 220 deg. C. under 103-105 mm. absolute pressure vacuum for 1.5 hr. Water and very small amounts of what seem to be fatty acids are removed at about 90 deg.

After cooling to 50 deg. a stoichiometric amount of phosphoric acid is added to neutralize the caustic soda catalyst. The mixture is stirred vigorously and 1 percent of an acid-activated clay is added. The reaction mass is then heated to 100 deg. under vacuum momentarily.

This mixture is cooled to 50 deg.

and filtered to remove the clay. The product—containing about 38 percent monoglycerides—is suitable for use in food products.

Modifications of the process, of course, can easily be made to simplify the equipment setup and design. Both hydrolysis and esterification, for example, could probably be carried out in a single, suitably-designed reaction vessel (for clarity, each step is shown in the flowsheet as taking place in a separate vessel).

Salable byproduct of the NRRL direct process is two-thirds of the fatty acids formed in the hydrolysis reaction. Credit for these acids is important in determining the economics of the process.

New Pulp Mill to Tap Timberland in Texas

Construction of a \$30 million pulp mill at Evadale, about 50 miles north of Beaumont, Tex., will be undertaken by the joint owners, Houston Oil Co. and Scott Paper Co.

The companies have applied for a certificate of necessity. If this is granted, work will start at once.

The mill will be built on timberland owned by the Southwestern Settlement & Development Corp., subsidiary of Houston Oil Co. The company owns about 650,000 acres of timberland in southeast Texas.

Pulp will be the only product of the plant. It will be shipped to other plants of Scott for conversion into paper. Some pulp will be marketed to other manufacturers.

Major Expansion Starts At Louisiana Refinery

Continental Oil Co.'s refinery at Lake Charles, La., will be expanded at a cost of \$24 million. This will increase daily capacity from 12,000 bbl. to 40,000 bbl. of crude charge.

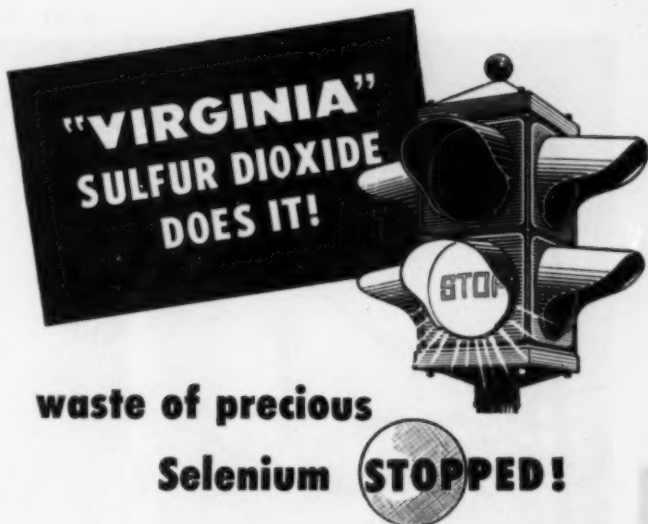
Work is expected to start immediately, and completion is expected late in 1952. Major contract has been let to E. B. Badger & Sons.

Processing units for aviation gasoline, motor gasoline, kerosene, burner distillate and diesel fuel oil will be installed.

Selected crude oils will be segregated and processed to produce residuum, which will be pumped to the Cit-Con Oil Corp. plant for production of high viscosity lubricating oils.

Highly aromatic feedstock will be produced and will be used in the carbon black plant that is being built next to the refinery by Continental Oil Black Co.

(Continued)



**"VIRGINIA"
SULFUR DIOXIDE
DOES IT!**

**waste of precious
Selenium STOPPED!**

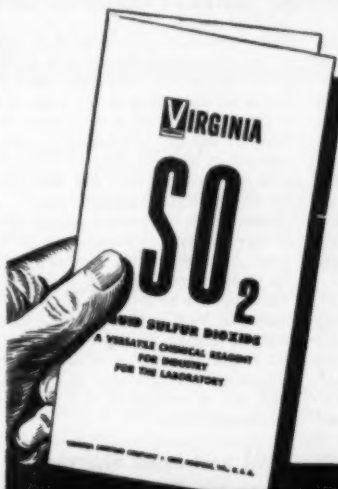
Selenium is a rare element. It has many important electrical applications; it is used for glassmaking. It does not occur in the pure state in nature, but is found in minute quantities in zinc and copper ores. It is hard to concentrate and separate from the reaction liquors in the refining of these metals. For years it was discarded as waste.

Our engineers found that soluble selenium salts are reduced in the presence of "Virginia" Liquid Sulfur Dioxide (SO_2). Elemental selenium is precipitated from the smelting liquors, and can readily be collected.

Thus another valuable element is made available to industry through a "Virginia" product and "Virginia" procedures. In the past 30 years, more than 40 diverse industries have found it advantageous to make free use of "Virginia" SO_2 and "Virginia" know-how stemming from long experience.

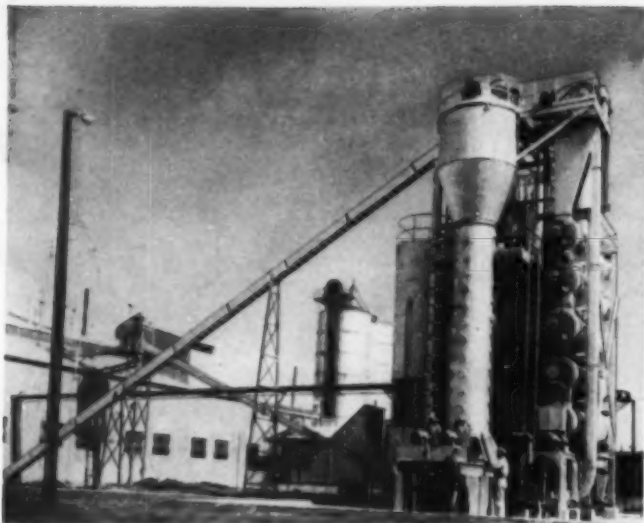
Our technical staff will gladly help you in exploring the possibility of efficient, economical use of low-cost "Virginia" SO_2 in your products or processes—as a reducing or neutralizing agent, bleach, antichlor, preservative, or pH control. Call us, or write today for the "Virginia" SO_2 booklet.

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ATLANTA



SOLVENT EXTRACTION UNIT at Sherman, Tex., proves . . .

New Extraction Process Pays Off

- . . . Gets more oil from cottonseed, soybeans, peanuts.
- . . . Puts oil milling on year-round basis.
- . . . Widens economic operating radius of big Texas mill.

Oil extraction is put on a high tonnage basis and that old bugaboo of cottonseed processors—off season idleness—is licked by a new process at the Sherman, Tex., plant of General Vegetable Co. Using the Exsolex process of V. D. Anderson Co., Cleveland, the new Texas plant daily extracts oil from 400 tons of cottonseed. And when the season is over, instead of shutting down, the plant switches over to processing soybeans, flaxseed and peanuts.

To sustain this volume output, General Vegetable is trying something new in oil milling: drawing upon outlying mills. Instead of the customary cottonseed, the Texas mill is processing cottonseed meats, less bulky and cheaper to haul over long distances. Meats come from mills as far as 160 mi. away. Delinting and dehulling are done at these six outlying mills. Thus volume production, with substantial savings, is possible at the large central extraction plant.

The Exsolex process combines continuous screw pressing and solvent extraction to give high yields. Rolled and cooked cottonseed meats are prepressed in five Anderson PreExpellers. The oil is settled, filtered and pumped to storage. Cake from the PreExpel-

lers is granulated, conditioned with moisture and heat, then flaked. Flakes go to the solvent extraction unit in which oil remaining in the press cake is extracted, leaving a meal with less than 0.5 percent cottonseed oil. After removal of solvent, this oil is mixed with the prepress oil, and the product stored until shipment.

Best of all, the process pays its way. It leaves only 0.5 percent oil in the meal, compared with 5 or 6 percent for conventional pressing equipment. This means a recovery of 30 to 50 lb. more oil from a ton of seed. Price-wise, it means \$8 more per ton, at 20 c. per lb. Anderson figures conservatively that the cost of a 400-ton unit can be written off in a year from its savings alone.

Acid and Lead Shortages Threaten Battery Makers

Shortages of lead, sulphuric acid and rubber are plaguing makers of storage batteries. Lead inventories of less than one week and sulphuric acid inventories of less than three days have been reported. A 15 to 30 day inventory of raw materials is normal.

Battery manufacturers use rubber for insulators and containers. While

their total rubber consumption isn't great, the shortage can tie up production as easily as the shortage of lead.

Reduced imports are primarily responsible for the current lead shortage. Imports might be increased if private U. S. buyers could compete on the market on the same basis as foreign lead buyers or if the government purchased foreign lead.

About 360,000 tons of lead and 81,000 tons of sulphuric acid are needed this year to meet estimated civilian requirements of 32.3 million automotive storage batteries. It's estimated that 5.5 million batteries are needed for new equipment and that replacement batteries are needed in about every other vehicle now on the road.

New Shell Plant to Produce Vital Benzene and Toluene

Two scarce and vitally necessary defense products will be the chief output of the new \$12,330,000 plant that Shell Oil Co. will build at its Deer Park refinery on the Houston Ship Channel. They are benzene and toluene.

Defense Production Administration has authorized a certificate of necessity for the new facilities.

Shell pioneered commercial production of benzene from petroleum. In 1947, during a temporary shortage of the product, the company's plant in California produced benzene commercially. That plant has been in continuous operation since March 1950.

The Deer Park unit—Shell's second benzene plant—will make more than 19 million gallons of benzene and 38 million gallons of toluene concentrates a year.

Raw material will be a gasoline fraction obtained in distilling crude oil. Processing will be carried on in a Platforming unit of Universal Oil Products Co. design.

Chemstrand to Make Both Nylon and Its New Acrylic

An agreement, making Chemstrand Corp. the first licensed nylon producer in the U. S., has just been signed by Chemstrand and E. I. du Pont de Nemours & Co. A major new plant—to produce about 50 million pounds of nylon yarn annually—will be built near Pensacola, Fla., by Chemstrand.

The new Florida nylon plant will employ between 3,000 and 4,000 persons, including 200 to 300 technicians.

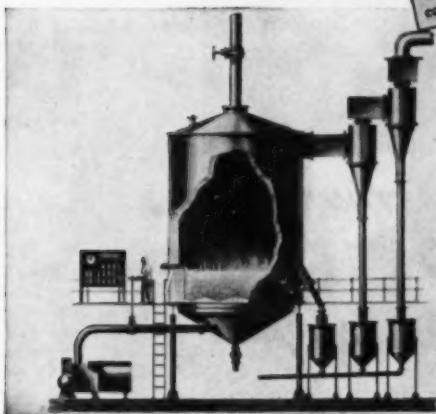
In addition, Chemstrand will pro-

(Continued)

Can you use 14-15% SO₂ GAS from PYRITE

Dorrco FluoSolids will produce it . . . at lower investment and operating costs than conventional roasters.*

FACTS ON SO₂ PRODUCTION BY FLUOSOLIDS



GAS STRENGTH will average 14-15% SO₂ dry basis from pyrite carrying 48-50% sulphur.

GAS CLEANING EQUIPMENT is smaller because of smaller gas volumes.

FEED can be relatively coarse . . . flotation concentrate to 35 mesh—fig or table concentrate to 14 mesh.

MINIMUM MAINTENANCE . . . no moving parts exposed to high temperature—long refractory life.

NO SEALING . . . temperature accurately controlled below fusion point.

NO EXTRAORDINARY FUEL is needed once fluidized bed is up to calcining temperature.

PROCESS SHUT-DOWNS of two or three days present no roasting problem.

COMPLETE INSTRUMENTATION in operation eliminates the personal factor.

● Sulphuric acid manufacturers and all users of sulphur dioxide faced with a shortage of elemental sulphur will find in FluoSolids an economically feasible means of tapping sulphides as an alternate source of SO₂. Utilizing the principle of fluidization, The Dorrcro FluoSolids System is a distinct departure from conventional roasters. It brings SO₂ production from those sources down to a reasonable investment and operating cost level.

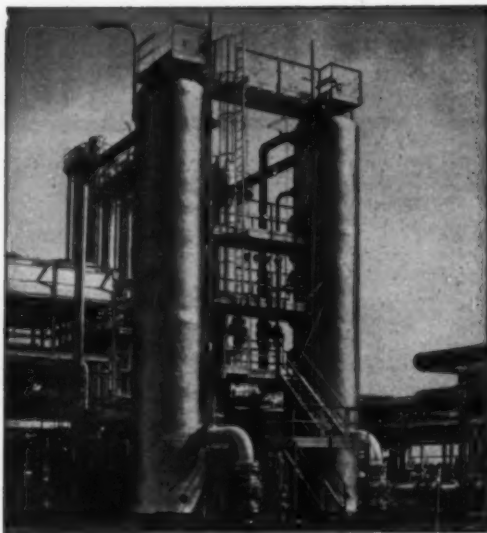
Its economy, simplicity and ease of operation are indicated by the facts above. For more detailed information write to The Dorr Company, Stamford, Conn., or in Canada, The Dorr Company, 80 Richmond Street West, Toronto 1.

*FluoSolids is a trademark of The Dorr Company, Reg. U. S. Pat. Off.



WORLD - WIDE RESEARCH - ENGINEERING - EQUIPMENT

THE DORR COMPANY - ENGINEERS - STAMFORD, CONN.
Associated Companies and Representatives in the principal cities of the world



Panoma has found
FLORITE
"very satisfactory"

The Panoma Plant of the Panoma Corporation, near Hooker, Okla., uses Florite in its dehydration towers, which were handling daily at last report, 85 million standard cubic feet of natural gas at a pressure of 675 pounds. They were designed to handle 140 million standard cubic feet at 750 pounds pressure. Gas dehydration is required in preparation for pipeline transmission.

This large modern plant has been in use since November, 1948, and, according to a report of the Panoma management at the end of a year, "has operated very satisfactorily."

Floridin Products, adapted to a wide range of industrial and technical uses, include especially prepared forms of

FULLERS EARTH

as well as two grades of Florite, which is a

BAUXITE-BASED ADSORBENT

Your inquiry will be given careful attention.

FLORIDIN COMPANY

Adsorbents . . . Desiccants . . . Diluents

News, cont. . .

duce 30 million pounds a year of its new acrylic fiber in a plant now building at Decatur, Ala. Output of the acrylic fiber, coupled with the added nylon production, will be a big boon to the fiber-short defense economy.

The government has granted certificates of necessity to Chemstrand for construction of both the nylon and acrylic plants. Chemstrand recently borrowed \$110 million to finance its venture into fibers.

Formed in 1949, Chemstrand is 50-50 owned by American Viscose Corp. of Philadelphia and Monsanto Chemical Co. of St. Louis. It was organized to develop the new acrylic fiber. Large-scale production in a pilot plant at Marcus Hook, Pa., indicates that the acrylic fiber can be used alone or blended with cotton, wool and rayon.

News Briefs

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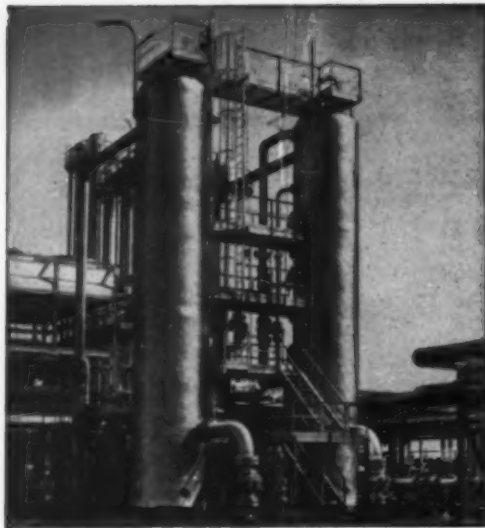
World's largest vacuum flasher—a 55,000 bbl.-per-day unit—is going on stream at the Richmond, Calif., plant of Standard Oil of California. With a height of some 100 ft. and a maximum diameter of 27 ft., it will provide 30,000 bbl. of feed each day for Standard's cat cracker. Job was done by M. W. Kellogg Co.

More refractories will be made by Harbison-Walker Refractories Co. as a result of a \$22 million expansion program. Latest plans call for a \$3.5 million silica plant near Downingtown, Pa., to produce materials for lining industrial coke-making furnaces. Harbison-Walker expects a 25 percent increase in sales to result from the expansion program.

Cement output will double to 4,000 bbl. daily at the Rillito, Ariz., plant of Arizona Portland Cement Co. Cost of the expansion will be close to \$3 million. Arizona Portland is the state's only cement producer.

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has gained such rapid acceptance that 12 mills have already converted to the new method that "fixes" dyes with hot oil instead of water. The revolutionary process cuts dyeing time of some fabrics from hours to minutes, saves chemicals, gives an improved finished cloth.

A cheap and highly efficient iron catalyst has been substituted for the tin catalyst formerly used in the coal hydrogenation demonstration plant of the Bureau of Mines at Louisiana, Mo. The unit's sixth experimental run, just completed, yielded 3.7 bbl. of oil per ton of moisture-free coal.

Hydroponics—chemical farming without soil—is now being planned on a vast scale in Florida. Four retired businessmen hope to set up a \$1 million soilless agriculture farm at Boca Raton to grow vegetable crops on a year-round basis.

Two new plastics developments come from a research program sponsored by the Manufacturing Chemists' Association at MIT: (1) a fast method of controlling cure in commercial molding operations; (2) the discovery that molecular reorientation will triple the tensile strength of polystyrene. This may lead to polystyrene fibers for special-use fabrics.

Canada's latest and largest fluid catalytic cracker is going up at the Sarnia, Ont., refinery of Imperial Oil, Ltd. The cracker—rated at 25,000 bbl. per day—is part of a modernization program that will up the refinery's capacity by almost 30 percent or to 71,000 bbl. daily. Canadian Kellogg Co., Ltd., is building the new units.

Expansion plus: Kaiser Aluminum & Chemical Corp. will appropriate another \$65 million for its reduction plant near New Orleans, bringing the new total to \$145 million. Kaiser is also scaling up expansion of its Baton Rouge aluminum plant by an added \$7.5 million, thus making a \$14 million expansion there. Preliminary engineering for the additional 100,000 tons of metallic aluminum has been completed.

More benzene is the goal of the \$3.3 million expansion that Atlas Process Co. has begun at Shreveport, La. When it starts operating in the first quarter of 1952, the new benzene unit will have capacity to produce 17,600 gal. of benzene daily. Major facilities: an extraction distillation unit designed by Shell Development Co. for recovery of benzene and a Platforming unit designed by Universal Oil Products Co. —End

With This NEW Improvement Niagara "No-Frost Method" puts you a big step ahead in trouble-free, automatic refrigeration or freezing

Niagara "No-Frost Method" keeps frost and ice COMPLETELY OUT of your cooling, chilling, freezing or cold storage.

It uses Niagara No-Frost Liquid Spray to keep frost and ice from ever forming. It gives you, automatically, refrigeration with no defrosting, and full capacity NEVER cut down by ice building up progressively on refrigeration coils.

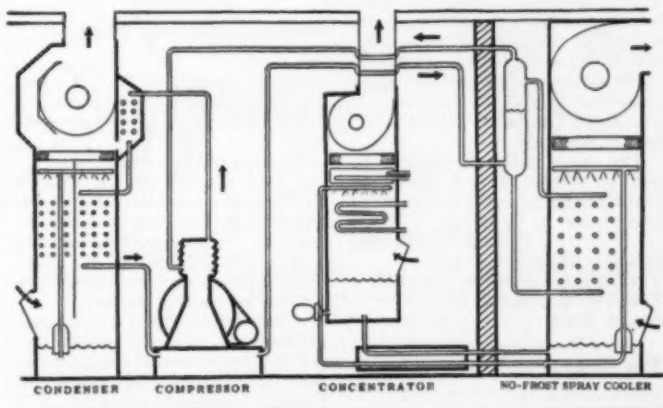
Now, a NEW design No-Frost Liquid concentrator, using a new principle, takes away moisture as fast as it is condensed by evaporating it at low temperature—not boiling it away at high temperature. It has 14 times the capacity of the old method per dollar of investment—one concentrator will handle a battery of high capacity spray coolers.

This gives you more refrigeration at lower cost; less machinery in less space. You operate at high suction pressure, saving power and wear and tear on compressors.

The extra capacity and lower cost both for equipment and operating makes this method advantageous for every type of refrigeration use—both for freezing and for moderate temperatures—for large "live" loads as in meat chilling or in fruit and vegetable pre-cooling—for rooms that are filled and emptied of product daily, such as milk rooms and terminal storage warehouses.

You get true trouble-free refrigeration . . . No brine . . . no salt solution . . . no dirt . . . no mess . . . It is entirely clean; you get rid of dirt and odors. You reduce both equipment and operating costs.

For complete information write to the Niagara Blower Company, Dept. CE 405 Lexington Avenue, New York 17, New York.



A simple method, easily maintained. Saves a third of your refrigeration cost. Ask for Niagara Bulletins 118 and 119.
(ADVERTISEMENT)

Readers' Views & Comments



Caustic Cell for Trainees

Sir:

... we are putting up a new caustic soda plant that will use the Krebs mercury cell to produce 20 long tons a day of rayon-grade caustic. This single cell (shown above) has been assembled to train our personnel in how to erect and operate the cells.

All the chlorine will be converted into hydrochloric acid. Part of this will be made into ammonium chloride, the remainder marketed as acid. Our caustic unit, the first large rayon-grade caustic soda plant (in India) ... will supply the rayon plants in the country.

Our ammonium chloride plant is also India's first. Part of its product will supply requirements of the metallurgical and dry cell industries. We will market the surplus chloride as fertilizer. The new units will be adjacent to the ammonium sulphate and superphosphate plants of Fertilizers & Chemicals, Travancore, Ltd. (FACT) here at Alwaye.

The entire factory is expected to cost \$1,750,000. It will commence trial operation by next January and go into production by March. ...

R. V. RAMANI
Director, Managing Agents
The Travancur & Mettur Chemicals
Elur, Udyogmandal P. O.
Alwaye, India

Too Many Man-Hours

Sir:

Company approval has now been obtained for giving you process labor figures for the manufacture of nitroglycerine.

The figure for our xxx plant is 3.2 man-hours per ton of nitroglycerine, including the neutralization operation. Omitting neutralization, our figure is 2.13 man-hours per ton.

NAME WITHHELD

Plant Engineer
Explosives Dept.

► Our factor of 4.5 man-hours per ton of nitroglycerine, was too high for this efficient plant.—Ed.

Sulphur: Whence & Whither

Sir:

For some time we have been searching for a comprehensive explanation of the flow of sulphur and sulphuric acid from production into consumption. Such an exposition, together with the relative importance of both the various sources and the ultimate markets for these chemicals, appears on p. 265 of your April issue.

This flow chart provides a simplified version of a very complex subject. We would like your permission to include it in an internal report which our department prepares for the use of our company's management. ...

R. B. ARMSTRONG

Manager
Business Analysis &
Market Research Dept.
American Enka Corp.
New York, N. Y.

► Said one authority in Washington about our April chart on sulphur sources and markets: "... the most detailed breakdown yet published."—Ed.

Crackers: TCC and Fluid

Sir:

In your April issue (p. 111) you gave rough estimates of the steam and water requirements of various processes.

We are somewhat puzzled that ... four times as much water is required for Thermoform catalytic cracked gasoline as for fluid catalytic cracked gasoline. ... All comparisons we have seen to date indicate that the TCC process requires less cooling water than the fluid cat cracking process.

... we suspect that 5 gal. of water per lb. of product would be about correct for the complete unit, starting with feed preparation and going through a complete gas plant. We doubt very much whether it would be possible to produce a gallon of catalytic gasoline by fluid cracking and use only 1.25 gal. of water unless only a

portion of the complete unit was considered.

ARTHUR V. DANNER

Manager
Process Promotion Div.
Socony-Vacuum Oil Co.
New York, N. Y.

► Our TCC figure of 4.7 gal. of water per pound of charge included feed preparation and cracking only, whereas the fluid catalytic cracking figure of 1.2 gal. per pound of charge included cracking and fractionation only. Our figures were therefore not comparable.

Socony-Vacuum reports 5.5-6.0 gal. of water per pound of TCC gasoline for a complete plant using the most modern airlift design. A complete catalytic cracking unit would require approximately the same amount of water per pound of product gasoline.—Ed.

Advt.

Sir:

We read and enjoyed your May review of Eskell Nordell's new book on water treatment, but want to take issue with your statement "there is no other recent book on water treatment." On Dec. 15, 1950, this association published the second edition of its manual, "Water Quality & Treatment," which I think you will find quite as recent, quite as thorough (except for industrial processes) and a good deal more succinct and more reasonable in price (451 pp., \$5).

The reason you probably overlooked the book in the first place is that we've been too stingy to send review copies to publications not strictly in the water works field. We're willing to make up for that now if you're interested in a copy for review.

ERIC F. JOHNSON

Assistant Secretary
American Water Works Assn.
New York 17, N. Y.

► Reader Johnson succinctly corrects our misnarration.—Ed.

How Much Textile Chemicals?

Sir:

If possible, will you please furnish data on the amounts of specific chemicals consumed by (1) the textile industry, (2) synthetic fiber manufacturers, by fibers? Such end-use data would be a useful aid in estimating requirements for these chemicals in the future.

Will you also define what manufac-
(Continued)

FOR SALE!

One (slightly used) Crystal Ball

Not a bad crystal ball... as crystal balls go... but lately it has a habit of getting cloudy when we need it most. For instance: take the case of VISQUEEN* film.

As you probably remember, VISQUEEN film was originally developed for the specific use of the armed forces. What they wanted was a polyethylene film such as had never been seen before... strong, durable, chemically inert, flexible and all the other qualities you know so well... a film that would meet rigid specifications yet be economical to use. *They got it!* And now, like many another reserve... VISQUEEN film is being called back to active service.

And that's our problem. While our Defense requirements get bigger and bigger... our customers delivery will of course dwindle. So we searched our crystal ball. And the only thing we could find is that we will have to ask you to please be patient... we're working hard, and we'll work harder to make every effort to fill your orders. You may be cut down... but we promise we will do the best we can to get VISQUEEN film to you.

*T.M. The Visking Corporation

VISQUEEN Film... A Product of

THE VISKING CORPORATION
PRESTON DIVISION • TERRE HAUTE, INDIANA

In Canada, Visking Limited, Lindsay, Ontario

CHEMICAL ENGINEERING—July 1951



IMPORTANT!

VISQUEEN film is all polyethylene, but all polyethylene film is not VISQUEEN. VISQUEEN is the only film produced by the process covered by U. S. Patent No. 2461975. Only VISQUEEN film has the benefit of the research and extensive technical experience of The Visking Corporation, pioneers in the development of polyethylene film. Be sure. Always specify VISQUEEN film for superior tear and tensile strength and greater uniformity.

"SOME POINTS to sleep on"



... regarding HARRISBURG Seamless Steel Cylinders for High-Pressure Gases

- ✓ Made by America's gas cylinder pioneer
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- ✓ Fabricated on specially designed equipment
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- ✓ Any quantity deliverable... anywhere

Write for catalog and prices

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STEEL CORPORATION**

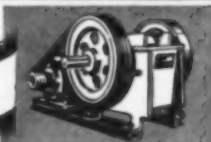


Custom-Built Quality Products in Quantity
99 YEARS IN PENNSYLVANIA'S CAPITAL

Harrisburg 16, Pennsylvania

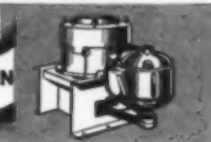
MASSCO Laboratory Crushers & Pulverizers

LABORATORY JAW CRUSHER



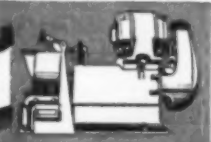
Double acting jaw delivers two blows per revolution, speeds crushing. Forward and downward motion increases capacity over conventional stroke, particularly on moist materials. Hand wheel replaces usual crank or skirts for jaw opening adjustment. Discharge openings 1/4" to 1 1/2" available. Easy to use, compact and relatively light weight welded steel construction.

GY-ROLL REDUCTION CRUSHER



Reduces 1/2" feed to as fine as 10 mesh in a single pass. Very high capacity and low power consumption; replaces bulky, noisy equipment such as rolls and coffee mills. Two sizes available, 6" and 10".

LABORATORY PULVERIZER



The Massco-McCool is a disc-type grinder designed for pulverizing to fine meshes in one operation. Planetary movement assures long grinding surface life. No gears—reduces power; 100% anticollision ground fabricated bearings; grinds more samples per hour at lower cost.

WRITE FOR SPECIFICATIONS AND PRICES



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SUPPLY COMPANY

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READERS' VIEWS, cont. . .

turing processes are included in the designation "textiles" as shown in the statistics on pp. 130-136 of your February issue?

F. LAMAR WOOD

Textile Division
National Production Authority
Washington 25, D. C.

► Our detailed estimates on the amounts of chemicals used by the textile industry will appear in our August issue. Included are the raw material needs for each of the major synthetic and semi-synthetic fibers.

We consider dyeing, scouring, water treatment, bleaching, printing, finishing and waste disposal as operations where chemicals are used by the textile industry.—Ed.

Re:Submerged Combustion

Sir:

The brief description of the item in your April issue, pp. 193-4, indicates that a "Chemico" drum-type concentrator is used (to concentrate phosphoric acid) at the Wendell, Idaho, plant of Gates Bros., Inc. . . this is not submerged combustion.

What is the basis of the statement that fuel efficiency is 90 percent? Percent of what? Evaporation of city water by submerged combustion of Philadelphia city gas (Dec., 1949) produced the following heat distribution in pilot plant test runs:

	Percent
Sensible heat of dry fuel gas	2.7-3.0
Sensible heat of water of combustion	1.1-1.2
Latent heat of water of combustion	8.8-9.2
Preheating feed water	12.0
Evaporation of feed water	68-69
Convection and other losses	6-10

Gross heating value of fuel gas 100

Thermal efficiency is 80-81 percent of the gross heating value (530 Btu. per cu. ft.) of the fuel gas. For commercial installations a thermal efficiency of 85 percent can be obtained.

E. W. GEIS

Chemical Engineer
3969 Richmond Street
Philadelphia, Pa.

Runner-Up to Corrosion

Sir:

Mr. Scott's article on steel protection (April, p. 135) is of considerable interest to me as I have gone through two similar studies and am now in the midst of a third for a client. So far, none of them has been any more revealing than Mr. Scott's.

Most coating films have at least fair resistance. The chief offender seems to be porosity, with abrasion a runner-up. Sharp edges, corners, etc., are

focal points of failure and all-welded structures with a minimum of surfaces and crevasses are certainly far easier to maintain.

The use of corrosion resistant steels may be justified; Bethlehem has an alloy suitable for structures that is supposed to have much better than average resistance. I have on occasion used Type 304 stainless structural members.

For the most part, however, in my bouts with corrosion I have come in second!

ALBERT W. SPITZ

Registered Professional Engineer
437 N. Sterling Road
Elkins Park, Pa.

► And so, evidently, have most other engineers. That's why we're going to have more on the subject. Then more of you can compare notes before—rather than after—your bouts with corrosion.—Ed.

What Price Plants?

Sir:

I like your May article "What Price Process Plants?" which I saw in your office some weeks ago. I am sure this article will be of considerable value for preliminary estimating.

We have found your previous articles in this same series quite interesting. Your graphic method does something more than merely supply information; it presents it in a rather comparative form. The brief text reveals some of the difficulties and problems of collecting data of this sort.

I wish there were indications as to the type of process used in certain cases. There are instances, I am sure, of feasible commercial processes covering a wide range of capital numbers for manufacturing the same chemical. There is no clue in the article to the type of process related to the capital cost shown.

Since engineers are being called upon with increasing frequency to make evaluation studies or supply "quickie" estimates, I would like to see more such information collected and published . . . you are performing a very useful service in making these figures available to us.

W. T. NICHOLS

Director,
General Engineering Dept.
Monsanto Chemical Co.
St. Louis, Mo.

► Watch for maintenance cost estimation articles, too.—Ed.

We welcome pertinent letters from our readers. Address: The Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

Maybe it all *does* look pretty much the same at first glance. But when a firm has been mak-

ing wire mesh for 70 years man and boy, there's bound to be a little more to it than meets the eye—a little more know-how in engineering and weaving, a little more quality in the product, a little more service and satisfaction to the user.

WIRE MESH

JELLIFF WIRE MESH is woven in all ductile metals

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problems...

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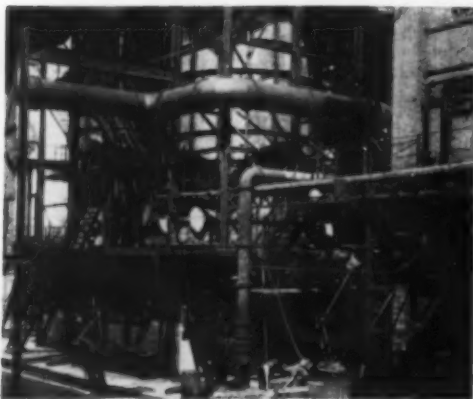
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The H. M. Harper Company
8204 Lehigh Ave., Morton Grove, Ill.
Send my copy of new Harper Catalog.
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Name.....

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Anhydrite, mined on the premises, is treated with sand, coke and ashes containing alumina to produce SO_2 and cement clinker. Gas is completely dried in towers, left, before going to converters, right.

Anhydrite Fights Britain's Sulphur Shortage

ICI's old sulphuric acid-from-anhydrite plant looked so good to sulphur-starved industrialists, they decided to chip in on a new and bigger model.

British industrialists, casting around for ways to ease grave sulphur shortages, took a hard look at ICI's sulphuric acid plant at Billingham which uses anhydrite mined right on the premises. What they saw prompted them to join ICI in investing \$10 million-odd in a similar plant at Merseyside. Under construction now, it should begin producing 150,000 tons of sulphuric acid annually within two years.

The Billingham plant produces 100,000 tons a year of 100 percent sulphuric acid and a somewhat larger quantity of high grade cement clinker. Anhydrite (which occurs in many parts of Britain) comes from a deposit 600-700 ft. below the surface at the plant site. It is the only plant of its kind operating on a large scale at an economic rate. It has provided ICI engineers with over 15 years' experience to apply to the new venture. They've learned, for instance, that an up-to-date converter system can improve upon the old plant's 89 percent over-all conversion to sulphuric. But the general outlines of the process will be much the same.

The process involves: heating to-

gether anhydrite, sand, coke and ashes containing alumina; evolution of sulphur dioxide and the formation of a cement clinker; conversion of sulphur dioxide into sulphuric acid in a conventional contact plant.

All raw materials except the anhydrite, which is dry, are first of all passed through rotary dryers heated by coke-oven gas. Next, separate storage bunkers discharge the raw materials to a common collector belt in proportions calculated to yield a satisfactory cement clinker. The belts feed two four-compartment ball mills and the mixed feed is ground to raw meal of required size and then elevated to storage bunkers. This insures a constant flow into two rotating kilns, 224 ft. long by 11 ft. in diameter, which are fired with pre-dried, pulverized coal blown into their hot end with the requisite primary and secondary air.

The calcium sulphate evolves sulphur dioxide, leaving lime to combine with the alumina and silica in the other raw materials to give cement clinker. The final, carefully controlled temperature of the solid material in the kilns is in the order of 1,400 deg. C.—somewhat above that used in ordi-

nary cement practice. The clinker passes through recuperators before discharge to recover some of the heat, and is subsequently transported by means of an aerial ropeway to the cement plant.

Before the kiln gases (9 percent sulphur dioxide) go to the converters they are passed through an elaborate purification system. They enter a cyclone to remove dust which is then recycled to the kiln. Partly cooled, they are subjected to a water wash to remove the remainder of the dust, then to a series of five parallel sets of two electrostatic precipitators to remove mist. Complete drying is accomplished in two packed towers working in series in which countercurrent washing with sulphuric acid is carried out.

The gases are circulated through the system by means of three centrifugal blowers, one of which is a standby. From the blowers, they enter the converter system through heat exchangers in counter flow to the outgoing gases. Two-stage conversion with platinum or vanadium catalysts is used. Sulphur trioxide formed is absorbed in the normal manner.

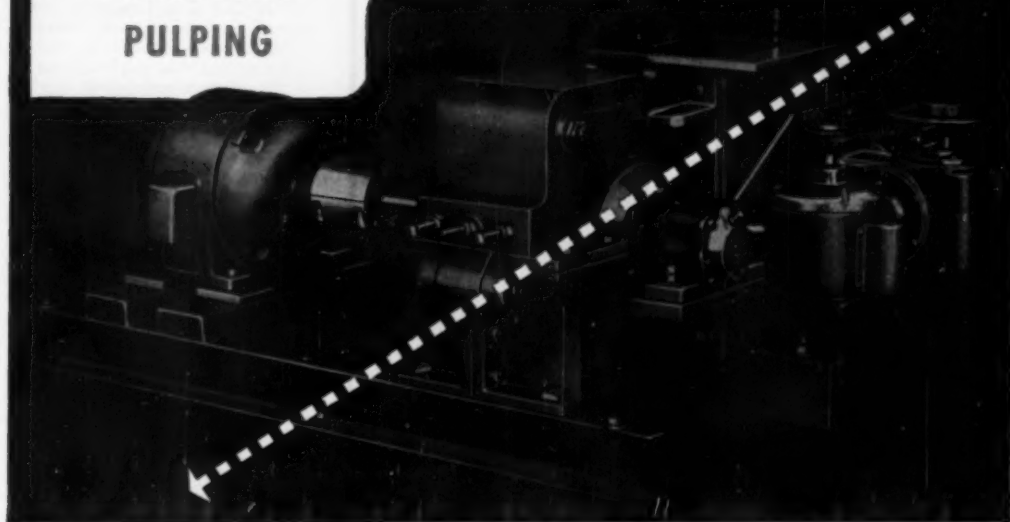
Exit gas from the plant is washed with ammonia in countercurrent giving a mixture of ammonium sulphite and bisulphite. This liquor is then treated with acid to release the sulphur dioxide which is returned to the plant.

Approximately 1.64 tons of anhydrite is consumed in the simultaneous production of 1 ton of acid and 1 ton of cement clinker. The fuel con-

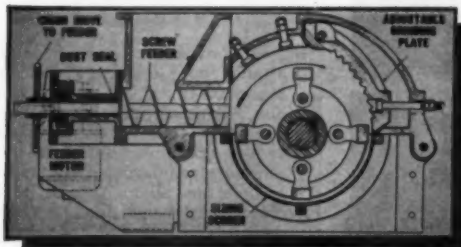
(Continued)

**WET GRINDING
SHREDDING
PULPING**

from thin slurry to filter press cake



WILLIAMS HELIX-SEAL HAMMERMILL



Sectional view of Helix-Seal Mill. Note long grinding plate against which the material is ground before it reaches the sizing screen. This plate is adjustable to compensate for wear.

WILLIAMS ALSO MAKES . . .

Heavy-duty hammermills; impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.

Williams Mills are used by many plants for the handling of wet materials . . . from thin slurry to filter press cake. When required, special construction is supplied to overcome corrosive reactions or friction hazards. Typical applications are:

- Refining wood pulp screenings when washing through mill with a large volume of water
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- Shredding cellulose acetate when suspended in process liquor
- Reducing vegetables and fruits to pulp
- Shredding food-packing plant refuse preparatory to drying for stock feed
- Crushing crude ore and rock when part of a wet processing system

Specific information about individual requirements will be sent gladly upon receipt of inquiry supplying details of your grinding, crushing or disintegrating problem.

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CRUSHERS GRINDERS SHREDDERS



Bendix-Friez

PRESENTS THE

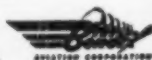
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FOR MEASURING
DAYLIGHT ILLUMINATION**

The Bendix-Friez Illuminometer is ideal as an aid to correct light-load prognostication through correlation with weather data and other known system factors. Based on U. S. Weather Bureau designs, this new instrument provides continuous recordings of daylight intensity in hundreds of foot-candles. An internal filter neutralizes heat ray effects and means are provided within the unit for calibrating the sensing element against U. S. Government standards. The Illuminometer is built and backed by Bendix-Friez, world's largest manufacturer of weather instruments and principal suppliers to the Government for 75 years.

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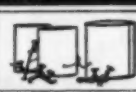
TANKS



TOWERS



CYLINDERS



VESSELS

FOREIGN NEWS, cont. . .

sumption is 0.266 tons of coal to a ton of acid.

In the kilns, the reaction goes practically to completion—all the sulphur in the anhydrite is evolved as sulphur dioxide. Not all of the sulphur dioxide appears as sulphuric acid, however. There are small losses in the washing of the gas and some sulphur passes out of the system as ammonium sulphate from the treatment of the gaseous effluent.

Reported this Month . . .

AUSTRALIA

Gel coat to stop fruit rot has been developed by D. W. Bingham & Co., Melbourne. Gel of carboxymethyl cellulose acts as carrier for cetyltrimethyl ammonium bromide.

Acetate rayon plant at Geelong, near Melbourne, will be set up by British Celanese Ltd. Capacity is planned in terms of 3 million pounds of filament annually. Celanese officials say frankly they couldn't make the project click without heavy tariff protection. Probably they will get it. A rival firm, Courtaulds Ltd., is believed to have been given definite assurances by the government when it decided to set up a rayon plant in New South Wales some time ago. The Courtaulds and Celanese plants, when in full production, will be able to meet Australia's entire demand for synthetics.

Biggest oil refinery on the continent is planned for Geelong by Britain's Shell Co. It will run off 136 million gallons of gasoline annually—more than a quarter of Australia's annual consumption and considerably more than the immediate neighborhood can absorb. It will be a conventional straight distillation unit designed by Shell's own engineering staff.

The refinery will mark a new departure in the marketing of petroleum products down under. American firms have built a few small plants at key locations, stressing bitumen and other heavy fractions which are expensive to ship over long distances. They have shied away from investing in big refineries which cannot dispose of their products locally. Marketing over long distances add a second freight to cost of importing the crude and makes it difficult to compete with refined products pumped ashore from foreign tankers. Shell has decided to try it anyway, perhaps

— gambling on the government's willingness to protect domestic refiners by putting up tariff barriers against imported petroleum products. In view of recurrent troubles in Middle and Far Eastern refineries, there is strong political and strategic incentive for such a move.

JAPAN

Chemical fibers manufacturers are seeking financial and technical tie-ups with American firms. The Tokyo Rayon Co. is planning to boost its production of Amilan synthetic fiber by a technical pooling agreement with Du Pont. Official permission has already been received.

Dai Nippon Celluloid Co. and Teikoku Rayon Co. will set a new Japanese-American company, jointly managed, for the manufacture of estron. Capital will come from American Viscose.

Asahi Chemical Co. plans to go into vinyl chloride manufacture with technical aid from Dow.

ITALY

Process for furfural extraction from vegetable pentosan-containing materials has been developed which makes use of a partial cycle of hydrochloric acid instead of usual sulphuric acid methods. Advantages: operates at ordinary pressures; higher yields; acid-free extraction residue can be used for production of steam in sufficient quantities to cover requirements of the process itself.

A continuous process, it has been tested in a pilot plant able to treat two tons a day of pentosan-containing materials. Yields reach 10 percent with rice husks (corresponding to 80 percent of theoretical yield), and 15 percent with corn cobs, in weight, based on the material processed.

Nitrogen producing plants to use methane gas of the Valley of the Po are being built at Novara and Ferrara by Montecatini, with a fixation potential of 20,000 and 50,000 tons of nitrogen, respectively. Both will be operating in 1952 and will raise the Italian potential output of synthetic nitrogen to 224,000 tons a year, 55 percent above the present demand.

ARGENTINA

National Atomic Energy Plant of Bariloche has been created by the gov-
(Continued)

CHEMICAL ENGINEERING—July 1951

The name **INLAND** means Quality Containers



Here's the best shipping insurance you can buy—the most durable drums and pails made anywhere today — Inland Steel Containers.

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FOREIGN NEWS, cont. . .

ernment. Its specific functions are to carry out atomic research, to carry out scientific experimental work connected with the application of atomic energy, to propose to the government measures tending to achieve a rapid and efficient utilization of atomic energy.

Insulin, ACTH and trypsin will be produced by Armour and Co. at a new plant in Buenos Aires. It will tap new sources of livestock raw materials—fresh pancreas for insulin and trypsin, pituitary glands for ACTH. It is estimated that about 20 percent of the potential capacity for these three drugs will be required to fill all Argentine needs, leaving 80 percent for world-wide distribution.

INDIA

First staple fiber plant in India will begin turning out 15 tons a day in about 18 months. Site: Nagda, Madhya Bharat. Owners: Birla Bros.

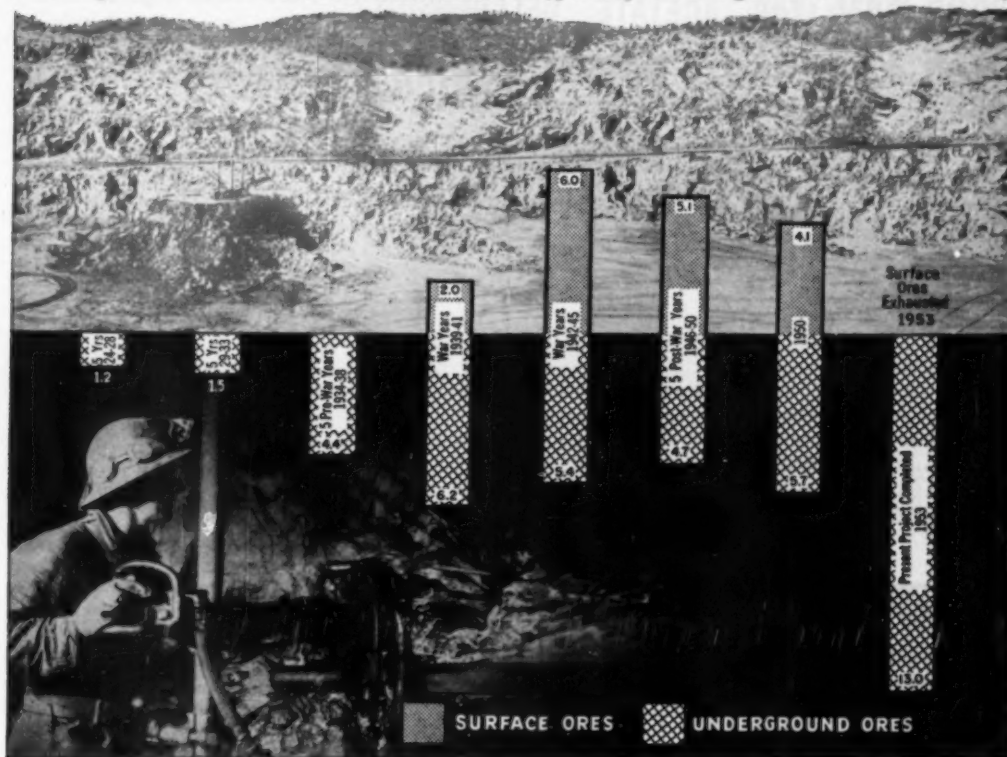
Auxiliary equipment includes a 25-ton sulphuric acid plant, a 5-ton carbon disulphide plant, thermal power station and a cotton, spinning, weaving and finishing mill. At first imported sulphite cellulose wood pulp will be the main raw material but it is planned to develop an indigenous source.

Kraft paper will soon be produced from bagasse as a result of experiments just concluded at the Indian Forest Research Institute, Dehra Dun. Now used as fuel for boilers, 7 million tons of bagasse (fibrous residue from crushed sugar cane) is produced annually in India's sugar mills. The new plan is to make coal available to the sugar mills and erect paper mills, alongside them. India could then produce the 40 million multi-wall bags needed by her sugar and cement industries each year. Current production is less than 4 million.

A pilot plant at the Dehra Dun laboratory has proved that bagasse pulp in conjunction with other long-fiber pulps does produce efficient five-ply multi-wall bags capable of carrying 80 to 120 lb. of gravel.

Silicon tetrachloride production experiments (undertaken to try to capitalize on India's surplus of chlorine) have been successful enough to warrant large-scale verification soon by the National Chemical Laboratory. (Continued)

Underground and surface ORE MINED (yearly average—millions of tons)



Underground for Defense

...started more than 10 years ago

STRENGTH...military and economic ...depends on productivity. And productivity depends on men who have devoted long years to their specialized chosen field of endeavour.

Such men with "know-how" mine nickel from the rocky rim of Ontario's Sudbury Basin...

By increasing output with maximum speed and drawing on reserve stocks of nickel previously accumulated, they helped raise deliveries of nickel in all forms during 1950 to 256,000,000 pounds... a record for any peace-time year.

This record, 22% greater than the 209,292,257 pounds delivered in 1949, was no accident...

In 1937, INCO launched a vast long-range project which now makes it possible to meet the military requirements

of the United States, Canada and the United Kingdom. In addition, nickel deliveries are being made to government stockpiles and the balance of the supply is being rationed among civilian consumers in all markets throughout the free world.

Since the inception of International Nickel, its fixed policy has always been to increase the supply of nickel. To meet today's needs, INCO went underground years ago.

Anticipating the eventual depletion of Frood-Stobie open pit surface ores, more than 10 years ago, INCO embarked on a program of replacing open pit with underground capacity. This required extensive enlargement of underground plants, development of new methods of mining not previously undertaken and the revamping of metallurgical processes to cope with difficulties in recovering nickel from

the new types and lower grades of ores which have to be reached.

Major expansion in output of nickel from underground operations is being driven to conclusion with utmost speed. There is still much construction to be done and a number of mining and metallurgical problems remain to be solved and tested in actual operation. Barring unforeseen interruptions, full conversion to underground mining should be completed in 1953.

When the present undertaking is completed, INCO will be able to hoist 13,000,000 tons annually, and the size of its underground mining operation will surpass that of any other non-ferrous base metal mining operation in the world.

This underground expansion is being completed by INCO without interrupting current production of nickel, which is at maximum capacity.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET
NEW YORK 5, N. Y.

PUMP COAL TAR, ACETATE, CELLULOSICS?



Capacities: 1-700 GPM
Discharge: 1000 PSI for viscous
liquids, 200 PSI for water

**provides greater dependability, longer
life—costs less to service and maintain**

The NEW *Sier-Bath* External Gear & Bearing Bracket Type SCREW PUMP

NEW FEATURES:

Single-point Alignment. Just one support point—base of pump body. External housings bolted directly to pump body, thus eliminating bearing strain and rotor misalignment due to change of position of pump elements.

"Dual-controlled" Rotors for less wear on bearings and timing gears. Axial control by heavy-duty thrust bearings—radial control by precision cut timing gears and heavy-duty roller bearings.

Fast Servicing—gear housings center line supported, doweled for accurate alignment. All parts automatically positioned by shoulders and locknuts.

ADDITIONAL ADVANTAGES:

Less Strain on Valves and Piping—pulseless discharge, no hammer or vibration. No Metallic Contact Between Rotors sustains high volumetric efficiency.

High Volumetric Efficiency reduces wear caused by erosion.

Only Suction Pressure on Stuffing Boxes reduces packing maintenance.

Direct-connected up to 1800 RPM.

Available in corrosion resistant alloys.

Special bodies, stuffing boxes and bearings for high temperature applications. Hopper type bodies for extremely high viscosities. Sier-Bath "Gears" Pumps for lower pressures and capacities.

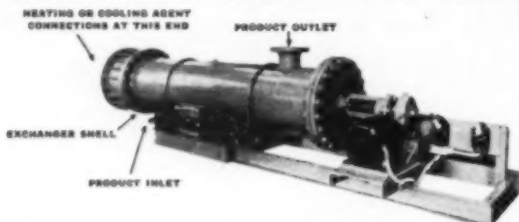
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Specifically designed for those heat transfer processes involving the continuous heating or cooling of viscous materials or fluids that normally deposit heat insulating films on exchanger tubes or autoclave surfaces.

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DAVIS ENGINEERING CORPORATION

1064 EAST GRAND STREET, ELIZABETH, N. J.

FOREIGN NEWS, cont.

tory, Poona. An extremely exothermic reaction between chlorine and ferrosilicon make the process economical from the standpoint of energy consumption. The experiments, on a 1-lb. scale, involve chlorination of ferrosilicon containing about 13 percent iron and 87 percent silicon carried out in a vertical silica tube furnace of 1½ in. diameter. Experimental work has been carried at 18 deg. C but indications are that even at higher temperature the reaction goes with sufficient evolution of heat so as to make it practically self-sustaining.

NORWAY

Aluminum will be produced at the rate of 50,000 tons a year at a \$33 million plant going at Sunndalsora in western Norway. It will be in operation by 1954. The project includes an increase in the capacity of the Aura hydroelectric station which is to supply power to the new plant.

New nitrogen installations, based on an improved production method, are being installed by Norsk Hydro at its Glomfjord and Heroya plants at a cost of about \$32 million. The new process, built around an improved form of electrolysis without any increase in consumption of electric power, will up yearly nitrogen output by 8,000 ton—equivalent to 25 percent of the company's million-ton yearly production of nitrogenous fertilizers. Further installations are planned which would raise production by another 30,000 tons of nitrogen.

PAKISTAN

Industrial alcohol plant is nearing completion at Takti Bhai Sugar Factory in North West Frontier Province (West Pakistan). Only other such plant in the country is at Darsana, East Pakistan.

Duty on various chemicals, drugs and medicines, not of British origin, has been raised from 34 to 36 percent of their value. According to a recent Pakistan-UK agreement, the rate applicable to British chemicals has been fixed at 26 percent.

ISRAEL

Enlarged sulphuric acid and superphosphate plants in addition to new ammonia and compound fertilizer plants will be completed by Fertilizers and Chemicals, Ltd., Haifa, in 1953. The \$15 million project will

multiply output of Israel's chemical industry ten times.

A chemical pilot plant for unit operations will be established at Haifa by the Hebrew Institute of Technology in collaboration with other agencies. With the help of additional equipment it will also be used for the temporary construction of pilot plants for special purposes.

CANADA

Largest fluid catalytic cracker in Canada is now under construction. The cracker—its capacity is rated at 25,000 bbl. a day—is part of an overall modernization program being undertaken by Imperial Oil Ltd. at its Sarni (Ontario) refinery. M. W. Kellogg, through its subsidiary, Canadian Kellogg Co., is also scheduled to build a 46,500 bbl. a day, two-stage vacuum and atmospheric distillation unit, as well as a light ends recovery system. Capacity of the distillation unit is also believed to be the largest in the Dominion. When the equipment is on stream, the refinery's capacity will be increased by almost 30 percent, or to 71,000 bbl. daily.

First permit for potash exploration and development in Canada has been issued in Saskatchewan to Bata Petroleum Ltd., Regina. At present no potash is produced anywhere in Canada. Imports, mainly from the U. S., amount to about \$4 million annually. Private interests report that development of Saskatchewan's resources could make Canada self-sufficient.

Under terms of the lease, Bata would have to spend a minimum of \$1 million to build a plant for potash production during the first three years of the lease. Since the potash beds are much deeper than those in the U. S. where shaft mining is used, Bata has agreed to experiment with brine mining. If this is not feasible the company will sink a shaft and go underground. The company hopes to have the work finished within two years.

Silicon carbide abrasive production of the Norton Co. will increase by 50 percent as its new plant at Capde-la-Madeleine, Que., gets underway. It will continue to make silicon carbide at Chippawa, Ont. Both are electric furnace plants.

First dry-ice plant in Canada goes into operation this month near Kaslo, B. C. Carbon dioxide gas received
(Continued)

ELIMINATE IRON CONTAMINATION



STEARNS Type "KB"
removing iron from
titanate

from powdered materials

USE THE IMPROVED STEARNS MAGNETIC SEPARATOR

Fine iron or abrasion in dry ceramic materials can be a very serious matter, and that's exactly what the D. M. Steward Mfg. Co., of Chattanooga, Tenn. found out. Processing critical titanate materials, they found that the presence of iron caused a serious reduction in the electrical properties of the material. But how to get the iron out positively and economically?

The answer was the STEARNS Type "KB" Magnetic Separator, a separator designed specifically for removing fine iron from powdered materials. A compact, rugged unit, the Type "KB" is perfect for batch operations and color work. Unified electrical control assures complete protection against contamination at all times.

STEARNS SEPARATOR FOR POWDERED MATERIALS

- Positive, dependable separation
- Low operating costs
- Continuous discharge of non-magnetic product
- Easy to clean
- For batch and small capacity operations
- EXPERIENCE ENGINEERED to meet your requirements



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Littleford Tanks are Designed to Fit Your Every Need

The Fabricators of Alloy Tanks require exacting, skillful workmen with the skill to shear, form and weld each tank with unerring precision.

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If you have a tank problem involving Alloy Metals, send your blueprints to Littleford for an estimate of cost, or write for Bulletin on Alloy Fabrication.

FABRICATORS OF PLATE AND SHEET METALS



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LITTLEFORD BROS., INC.
428 E. Pearl St., Cincinnati 2, Ohio

No Water Hammer! No "Hunting!" DAVIS No. 60 FLOAT VALVE

THE Davis No. 60 Float Valve, illustrated here, is unexcelled for dependable performance. It handles either hot or cold water with no "hunting," no "water-hammering." Opens easily against any pressure up to 125 p.s.i. and closes positively drip tight. No sticking; there is no internal packing to swell and cause excessive friction. Built in sizes, 1/2" to 12". Standard construction—composition disc, bronze trim. All bronze or stainless trim available. Contact your distributor or write.



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Established 1875

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FOREIGN NEWS, cont. . .

from nearby wells will be converted by compression and refrigeration into solid blocks at temperatures as low as -270°C .

Titanium dioxide slag, 250,000 tons of it, will be sold in the United States next year as a result of the \$30 million development of Quebec Iron & Titanium Corp. of Canada now nearing completion. The slag contains 70 to 72 percent titanium dioxide. To the Canadian market will go 175,000 tons of high grade iron.

Tariff concessions on chemicals, oils and paints give the expanded Canadian chemical industry new opportunities in the U. S. market. As a result of the Torquay trade talks Canada gained reduction of 50 percent in U. S. tariff on an extensive list of chemicals. For a number of them, it was the first tariff cut since high rates were introduced in 1930.

Sulphur plant planned for Copper Cliff, Ont., by Canadian Industries Ltd. will use byproduct gases from the operations of International Nickel Co. of Canada. The latter's oxygen flash-smelting process will be utilized.

Smokeless powder, TNT and tetryl will be produced at reopened \$14 million World War II plant. It will be operated by the new Canadian Industries subsidiary, Defense Industries (1951) Ltd.

Butanediol can be made through fermentation of sugar beet molasses by a process developed by the government's National Research Council. A plant would cost about \$2.5 million and production cost would be about 23c. per lb.

GERMANY

Houdriflow catalytic cracking unit is to be installed at the new Lingen refinery of Gewerkschaft Erdöl-Raffinerie Emsland. Located near the Dutch border in the new Emsland oil field, the installation will be the first of the modern moving-bed units to be built in Europe.

AUSTRIA

Stearates production in Austria is now adequate to cover the country's needs thanks to a large expansion of capacity at the Esco-Chemie-Dr. Sattler and Co., Vienna. This plant produces stearates of aluminum, barium, lead, copper, lithium, magnesium and zinc. —End

The Quick, Economical solution to **Heating Gases** and **Process Air**



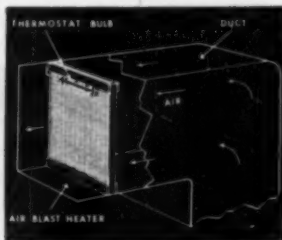
CHROMALOX Electric Heaters

CHROMALOX offers you a wide variety of electric heaters to fit the temperature requirements of your jobs and the physical dimensions of your equipment. CHROMALOX Units are the dependable, efficient answer to heating recirculating ovens. They quickly and simply convert air-conditioning systems to central heating systems. Units are available for heat treating ovens, annealing ovens, core and armature drying ovens and similar applications. Operating temperatures up to 1000° F. are easily achieved and accurately maintained by thermostat control. Standard units are quickly installed in existing ducts and multiple circuits can be supplied for modulating the heat output.

CHROMALOX

Electric Heat for Modern Industry

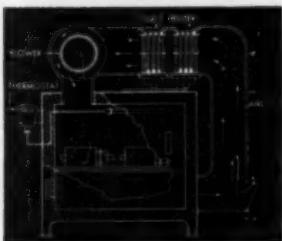
CHROMALOX *dependable, efficient* **HEAT**



AIR BLAST HEATER slides into duct for heating air under forced circulation. Two or more heaters may be mounted in same duct. Built-in bus-bar easily connected for single or multiple-circuit control.



FINSTRIP HEATER for drying, curing, space heating and other applications requiring heat under forced circulation. Heat is quickly dissipated by parallel-fin construction with minimum air-friction loss. Flanges simplify mounting.



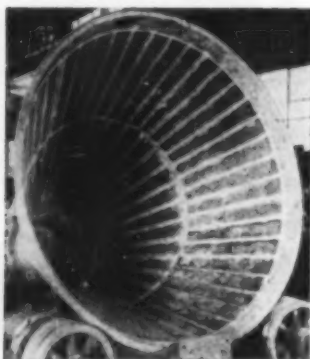
DUCT HEATER mounted in recirculation oven for temperatures from 400° to 1000° F. Multi-circuit units allow varying heat outputs. Moisture-proof construction is ideally suited to many jobs.

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Send for Catalog 50 and the useful booklet of application ideas "100 Ways to Apply Electric Heat". They are both yours without obligation.

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Construction Materials vs. Hydrocarbon Solvents



Hastelloy alloy B is the lining material for this alkylation tower cone.

Hastelloy

E. D. WEISERT, Haynes Stellite Co., Kokomo, Ind.

Hastelloy alloys have found wide and varied application in processing equipment handling hydrocarbon solvents. Although these alloys have excellent resistance to many organic compounds, they are used primarily where mineral acids and other severely corrosive agents are also present, either as part of the solution or as catalysts.

Equipment used in such processes as sulphonation, chlorination, and nitration often gives longer service without maintenance when key parts are made from Hastelloy alloys. In the sulphonation of benzene, for instance, downcomers of Hastelloy alloy D are used to introduce the superheated benzene vapors into a bath of concentrated sulphuric acid. Pumps and similar equipment of Hastelloy alloy B successfully handle ethylene chlorhydrin in the production of ethylene glycol. A third grade of Hastelloy alloy—alloy C—is commonly used to line vessels for the chlorination of benzene into hexachloride.

Alloy B is used in scrubber towers that remove hydrochloric acid from vinyl chloride and also as a lining in vessels that handle various alcohols. Equipment used to produce isopropanol is often partially constructed from Hastelloy alloy C.

In the petroleum industry, there are many examples of the successful use of these nickel-base alloys. Alloy D ball-check valves are used in great numbers. Alloy B is an excellent lining material for alkylation and isomerization towers (see cut) where the corrosive action of aluminum chloride and hydrogen chloride catalysts is too severe for steel equipment.

Lead

KEMPTON H. ROLL, Lead Industries Assn., New York, N. Y.

Tests show corrosion rates are greatest with carbon tetrachloride, tetrachloroethane and pentachloroethane. With ethylene dichloride there is no apparent reaction and with trichloroethylene the action is extremely slight.

Lead is satisfactory for use with solvents of the tetrachloride group providing an excess of moisture is not present. Moisture promotes formation of acid components and thus minimizes lead's corrosion resistance.

Benzene, toluene and xylene have no effect on lead. Tests show a solution of naphthalene in xylene has no action with lead. Nitrobenzene in itself does not effect lead but its presence in many acids has an accelerating effect on the corrosion rate of lead. Benzaldehyde has a similar effect, although its action is more selective in that in some cases it accelerates and in others retards.

Chlorimets

WALTER A. LUCE, The Duriron Co., Dayton, Ohio.

Chlorimet 2 and Chlorimet 3 are excellent materials of construction for handling solvents. Not only do they show this good resistance to the relatively pure solvents, but they have found wide application for use in contact with other severe corrosives often encountered with the solvents.

Like the high-silicon iron alloys, the Chlorimets have been particularly useful where hydrochloric acid and chlorine are present, such as in the manufacture of the chlorinated solvents. Chlorimet 3 pumps and valves are in service for handling these con-

ditions. Prior to their original selection for this type service, tests showed that a corrosion rate of only 0.9 mils per year was to be expected from this alloy in a chlorinated benzene solution containing chlorine and hydrochloric acid. Numerous Chlorimet 3 pumps are also giving excellent service at a chemical plant for handling hydrochloric acid and a solvent in the system for recovering the solvent. The temperature involved is 120 deg. F. Chlorimet 3 is often selected over Chlorimet 2 for handling hydrochloric acid at relatively low temperatures when the solution in question is suspected of being definitely oxidizing in nature.

Cements

RAYMOND B. SEYMOUR, Atlas Mineral Products Co., Mertztown, Pa.

Resinous cements based on furfuryl alcohol and phenol, as well as modifications of these products, have excellent resistance to aromatic and aliphatic hydrocarbons even at temperatures above 250 deg. F. Silicate cements are also completely resistant to these solvents but sulphur cements are badly attacked even at room temperature.

Cements based on filled vinyl type plastics and Thiokol are resistant to these solvents at room temperature but ready-mixed Thiokol cements are not recommended for aromatic hydrocarbon solvents. Products based on portland cement or asphalt are completely unsatisfactory for aromatic and aliphatic hydrocarbons even at room temperature.

Glass Lining

S. W. McCANN, The Pfadudler Co., Rochester, N. Y.

The solvents have no action on glass linings at room or elevated temperatures. Many solvent extractions are carried out in glass-lined equipment, and in many cases complete solvent recovery systems are used which consist of glass-lined still, condenser and receiver. These systems are especially useful where purity is essential and no metal contamination can be tolerated. There are also many installations that use glass-lined steel storage tanks for chemically pure solvents.

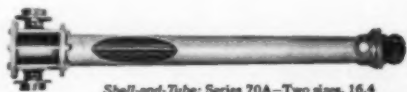
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"KARBATE" BRAND HEAT EXCHANGERS

IMPERVIOUS GRAPHITE FOR ALL PURPOSES!

The "Karbate" impervious graphite heat exchangers illustrated are used extensively as boilers, coolers, condensers, vaporizers, evaporators, heaters and absorbers in handling corrosive chemicals, either hot or cold. They *all* can be had in a complete size range. *All of them* offer the following advantages:

- Highest heat conductivity rate of the practical corrosion-resistant materials.
- Highly resistant to corrosion by acids or alkalis, hot or cold.
- Freedom from corrosion scale, as compared to metals.
- Immune to thermal shock.
- No contamination of product.
- Strong and easy to install and maintain.



Shell-and-Tube: Series 70A—Two sizes, 16.4 sq. ft., and 24.6 sq. ft. of outside surface area respectively. Tubes easily replaced in the field. Interchangeable single and double-pass construction.



Series 240A—70.6 feet of outside heat transfer surface. Easy tube replacement. Easily converted on job to single, double, or four-pass tube side flow by simple change of fixed covers. Steel, shell, oversize shell connections, impingement plates and drain and vent plugs integral with shell end castings. Stainless-steel baffles assembled with steel tie rods to form protective cage for tube bundle. Removable "Karbate" tube bundle. Write for catalog sections S-6690, S-6715 for details of applications, maintenance, sizes and characteristics of these exchangers.

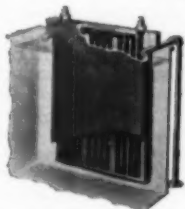


Plate heaters: Used to heat or cool corrosive liquids in tanks and vessels. Compact, completely assembled, easy to put in. Used in pickling, etching, plating and cleaning tanks. Complete size range. Models for horizontal and vertical mounting. Write for catalog section S-6620.



Style FH heat exchangers (Size 1 1/2"): Are especially recommended for tanks with sulfation depths of 16 inches or less. Write for catalog section S-6750.

Cascade coolers: For all cooling jobs involving corrosive gases and liquids. Complete cooler assembly may be made quickly from 4 standard items in 5 pipe sizes. Capacity easily enlarged or reduced by adding or subtracting standard sections. Compact construction to save plant room. No special supporting structure needed. Write for catalog section S-6780.



Concentric Tube exchangers: Available in two types. Series 10A is small, low-priced, gives true counterflow. Exceptionally good for small flow rates at narrow temperature differences... Series 20A manufactured with "Karbate" inner and outer piping, and is used to transfer heat between two corrosive fluids. Both have sectional construction, can be added to or subtracted from at will. Sturdy, can be moved from place to place after assembly, adapted to any method of mounting on floor, wall, or ceiling. Write for catalog section S-6670.

The term "Karbate" is a registered trade-mark of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

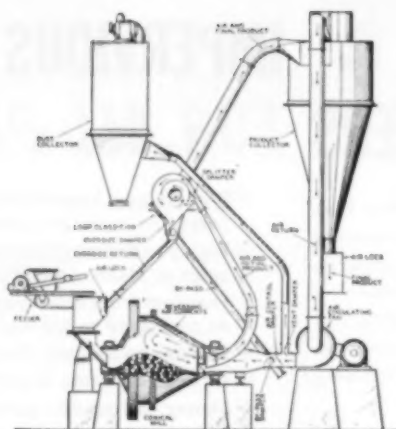
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

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A full line of "Karbate" impervious graphite pipe and fittings

for conveying corrosive chemicals includes: "Karbate" pumps of advanced design embodying impervious graphite case, impeller, and a rotary seal which eliminates the stuffing box. Pump prices reduced up to 33%. Write for catalog section S-7000 for pipe information, S-7200 for pump information.

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GALVANIZED STEEL
COPPER
ALUMINUM
BRASS

Also Tools for Applying.

FREE

Handy calculator—one side tells you which strap to use for any given corrosive condition; the other side determines length and weight of strap required for any blading operation.



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SM-4

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Corrosion CEMENTS

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CORROSION FORUM, cont. . .

Highly oxidizing services can result in excessive corrosion on Chlorimet 2 since this alloy contains no chromium. Chlorine is particularly severe in this regard and Chlorimet 2 should not be used when this corrosive is present. This alloy finds its best application in handling the solvents plus hydrochloric acid. For instance, one chemical company uses Chlorimet 2 equipment for handling 38 percent hydrochloric acid plus organic solvents at 115 deg. F. max. Good service is still being received after several years' operation.

In most instances where the chlorinated hydrocarbons are handled in the presence of chlorine and/or hydrochloric acid, either the high-silicon iron, Durichlor, or one of the Chlorimet alloys is applicable. Certain users desire the superior mechanical properties of the Chlorimets and select these alloys in preference to Durichlor despite the higher initial cost. Both alloys usually show very good resistance.

Stainless Steel

GRANT L. SNAIR, JR., Allegheny Ludlum Steel Corp., Brackenridge, Pa.

None of the hydrocarbon solvents are very corrosive to the stainless steels under most conditions where they are used, and the applications for stainless steel equipment are almost unlimited.

The halogen substituted hydrocarbon solvents (mainly compounds containing chlorine and bromine), as well as the aromatic solvents, are not corrosive to Types 430, 304 and 316 at most temperatures. However, in case any of the compounds which contain chlorine or bromine should hydrolyze in the presence of certain contaminants and create an acid condition, Type 316 offers best resistance.

The stainless steels are used extensively in refining and related processes for such installations as cracking stills, vessel linings, condenser tubes, bubble caps and trays where sulphur compounds which allow the formation of sulphuric acid are not present in excessive amounts. Type 316 resists pitting in the presence of condensing vapors.

Type 347 has been successfully used for gasoline fuel lines in airplanes. Types 302 and 304 are suitable for gasoline tanks, storage vessels, valves, pump parts, and pipe systems.

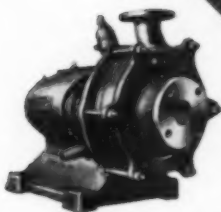
Large quantities of Type 302 are now being used with excellent results for fire extinguishers filled with carbon tetrachloride.

The vapors of some of these sol-
(Continued)

corrosion control—moulded by



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A Model 40
Series R Durcopump

Moulds for Durco castings are produced on mechanized lines like these. Other manufacturing methods are just as modern—as the many Durco corrosion-resisting alloys are cast, machined, and assembled into a wide line of valves, pumps, pipe, fans, and other corrosives-handling equipment.

Even the most modern facilities cannot keep abreast of every demand today, and certain Durco alloys and products are difficult to obtain. But that is where Durco's long experience and great variety of alloys and equipment may stand you in good stead. A technically-trained Durco representative may be able to show you how your corrosives-handling problem can be solved with *available* means. That is his job today. Write, phone or wire, asking that the nearest Durco representative visit your office at your convenience.

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CORROSION FORUM, cont.

vents, particularly carbon tetrachloride and trichloroethylene, are employed in Type 304 tanks for degreasing metal and glass. Type 316 is more resistant to pitting caused by excessive contamination of the solvent by grease, oil, certain acids, or moisture.

Mixtures of greases and oils with solvents, or carbon deposits resulting from the incomplete combustion of gasoline, kerosene, etc., should not be permitted to come in contact with stainless steel surfaces which are to be heated in the vicinity of 1,500 deg. F. where carburization of the metal might occur. This condition impairs the corrosion resistance and increases the rate of oxidation.

Worthite

W. E. PRATT, Worthington Pump and Machinery Corp., Harrison, N. J.

Most hydrocarbons, when pure, are non corrosive to metals, but still there are many hundreds of Worthite pumps in service handling a wide variety of hydrocarbon liquids. The reason for this is that the hydrocarbon is mixed or contaminated with some corrosive fluid, or that perhaps water is present and the process must avoid metal contamination which could be caused by rust or other metal compound.

Thus, our order cards show the names of many hydrocarbons, but only occasionally do they give the details of the corrosive agent present that demands the use of a corrosion resisting metal or alloy. Perhaps bronze or stainless steel pumps would answer many of the purposes. The reason that Worthington would ordinarily supply a Worthite pump rather than stainless is that it is usually available from stock and is much lower in price than a stainless pump built on special order. Worthington chemical pumps are not stocked in bronze and a bronze water-type pump lacks many features required in a pump for corrosive solvents. Bronzes are much weaker and more susceptible to seepage in handling solvents than an alloy such as Worthite.

Worthite pumps are in wide use in petroleum refineries and byproduct coke plants for handling many hydrocarbons, which may be contaminated by corrosive agents. Thus, lube oils, kerosene, gasoline, butane, propane, etc. may be carrying at different points such corrosive substances as sulphuric acid, hydrochloric acid, alkalis, and hydrogen sulphide. These frequently justify the use of an all Worthite pump, or some parts made of Worthite. Worthite pistons and rods have

been supplied for propane pumps. The use of Worthite centrifugal pumps for acid sludge is common where the hydrocarbons are present in sufficient quantity to be burned as a fuel. Mechanical seals are generally used on such pumps to avoid packing difficulties. In the recovery of toluene from petroleum, the hydrocarbon may pick up H_2S from some crudes so it becomes too corrosive even for stainless steel. Worthite pumps are used at this point in the process.

Byproduct coke plants and gas manufacturing plants have to pump hydrocarbons that are corrosive due to tar acids, or due to the presence of acids or alkalis used in treating processes. Typical services are benzene, toluene, xylene, "soda Thylox," "benzoin residue," raw light oil, tar acid, maleic acid, pyridine, naphthalene oil, ammonia compounds.

Many hydrocarbon solvents are handled in Worthite pumps due to the use of the solvent for extraction of a substance that by its presence makes the mixture corrosive. Thus propane or other solvent may be used for solvent extraction of fats and oils where fatty acids are the corrosive element, or tetrachloroethane may be used for degreasing or cleaning metals and it may pick up some corrosive agent in recycling. Monoethanolamine is used for extracting CO_2 from inert gases. In the presence of water the CO_2 can form carbonic acid so an iron pump has too short life. Worthite pumps have been used in this service. Tetrachloroethylene, a dry cleaning agent, can also pick up corrosive substances and that may be why a Worthite pump was ordered for this solvent. Prestone is not corrosive but a Worthite pump was ordered for low temperature service, which may or may not have been corrosive. Worthite is a particularly good metal for very low temperatures.

In the manufacture of some hydrocarbons some of the processes require treatment with an acid or an alkali, and before purification the hydrocarbon may be very corrosive to ordinary metals. Nitration is one such process involving nitric acid. After distilling "light oil" to obtain benzene, it is washed with caustic soda, sulphuric acid and water and redistilled, so Worthite pumps are economical to use at certain points in such processes. Aniline, chlorobenzene, nitrobenzene, nitrotoluene are typical hydrocarbons in this category.

In the manufacture of certain drugs, detergents, insecticides, soaps, etc., a hydrocarbon is used for the solvent. Some of the solutions involved contain highly corrosive agents.

(Continued)

AT YOUR FINGER TIPS

COLOR CODES for Pyrometer Wires

CALIBRATION FOR THERMOCOUPLES AND EXTENSION WIRES

TEMPERATURE	TYPE OF WIRE	WIRE NO.	WIRE SIZE	WIRE COLOR	WIRE LENGTH	WIRE RESISTANCE	WIRE TOLERANCE
0-1000°F	TYPE K	1	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE J	2	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE E	3	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE N	4	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE R	5	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE S	6	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE B	7	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE C	8	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE D	9	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE F	10	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE G	11	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE H	12	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE I	13	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE L	14	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE M	15	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE O	16	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE P	17	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE Q	18	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE R	19	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE S	20	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE T	21	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE U	22	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE V	23	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE W	24	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE X	25	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE Y	26	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE Z	27	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AA	28	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AB	29	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AC	30	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AD	31	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AE	32	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AF	33	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AG	34	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AH	35	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AI	36	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AJ	37	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AK	38	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AL	39	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AM	40	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AN	41	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AO	42	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AP	43	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AQ	44	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AR	45	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AS	46	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AT	47	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AU	48	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AV	49	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AW	50	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AX	51	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AY	52	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE AZ	53	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BA	54	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BB	55	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BC	56	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BD	57	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BE	58	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BF	59	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BG	60	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BH	61	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BI	62	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BJ	63	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BK	64	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BL	65	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BM	66	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BN	67	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BO	68	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BP	69	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BQ	70	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BR	71	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BS	72	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BT	73	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BU	74	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BV	75	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BW	76	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BX	77	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BY	78	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE BZ	79	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CA	80	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CB	81	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CC	82	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CD	83	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CE	84	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CF	85	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CG	86	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CH	87	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CI	88	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CJ	89	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CK	90	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CL	91	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CM	92	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CN	93	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CO	94	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CP	95	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CQ	96	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CR	97	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CS	98	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CT	99	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05
0-1000°F	TYPE CU	100	1/16"	BLACK	100'	1.10 ± 0.05	± 0.05

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**3-WAY FULL AREA, PACKLESS
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PIPE SIZES: 1, 1 1/4, 1 1/2 and 2 inches

We recommend this valve for controlling equipment where pressure must be alternately applied and exhausted as, for example, with diaphragm motor valves, air or hydraulic cylinders, etc. Classed as Bulletin #331 ASCO Valves, here are a few specifications: maximum pressure 125 to 250 pounds; minimum pressure 10 to 20 pounds. Suitable for handling air, water, gas, oil and other non-corrosive gases or liquids up to 180°F.

Since the automatic control of any alternating application and release of pressure is so important for efficient operation, we suggest that you bring your problems to the attention of our engineers whose experience goes back nearly 40 years.

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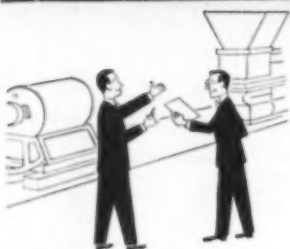
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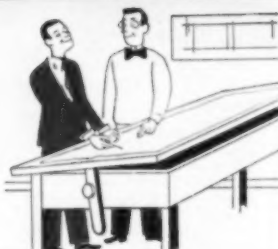
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SOME "DO'S and DON'T'S" IN BUYING DRYING EQUIPMENT...

(that will save time, money and headaches)



DON'T wait until the last minute to consider drying equipment—after your other process equipment has all been ordered or even installed.



DO call in Proctor engineers while your process is in its earliest planning stage. Drying is a major link in the over-all process—and may easily affect—or be affected by other equipment.



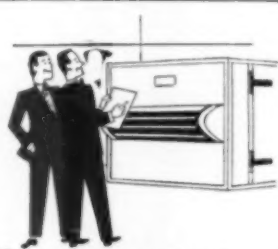
DON'T spend hours of your own men's time trying to work out your own design for a drying system. This is costly in man hours, effect and dollars.



DO call in Proctor engineers who will conduct necessary tests in their well-equipped laboratory at no cost to you and make recommendations for a system that will be designed to your specific needs.



DON'T base your final decision in the selection of a drying system entirely on the price tag or initial investment. Some customers have found this a costly experiment.



DO remember that you are buying "guaranteed performance" when you invest in a Proctor system that is designed to meet your needs and which will be meeting those needs before Proctor considers the transaction closed.



PROCTOR & SCHWARTZ INC.

711 TABOR ROAD • PHILADELPHIA 20, PA.

DO acquaint yourself more thoroughly with the Proctor approach to solving drying problems by writing today for Bulletin 343 and 361.

CORROSION FORUM, cont. . .

while others are only mildly corrosive but absolute freedom from metal contamination is required. So our records show that many hundreds of Worthite pumps are sold to pharmaceutical manufacturers and in lesser degree to manufacturers of the other end products mentioned. The solvents most frequently mentioned on orders are chloroform, benzene, carbon tetrachloride, acetone, toluene.

Glycerine is another hydrocarbon which is handled in the crude form in many Worthite pumps, the corrosive contaminants being fatty acids and sulphuric acid from the Twitchellizing process.

Finally, the plants manufacturing organic chemicals use hundreds if not thousands of Worthite pumps, and hydrocarbons are the basis of this business. Orders for Worthite pumps usually fail to identify the chemical any closer than "organic solution" or "organic salt solution." Apparently Worthite is suitable for a large number of the organic solutions handled in this industry.

Iron and Steel

ALBERT W. SPITZ, Reiter Engineering Co., Philadelphia, Pa.

Iron and carbon steel are universally used for pumps, piping, tanks and valves in both aromatic and aliphatic solvent service. When corrosion does occur, it is usually due to the presence of water or chemicals such as H₂S or SO₂.

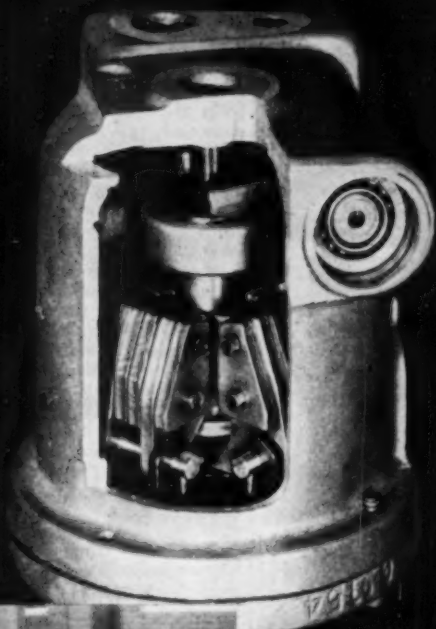
High-Silicon Irons

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

The high-silicon iron alloys, Duriron and Durichlor, are basically immune to corrosion by any of the commercial solvents and can be successfully used in their presence. However, since many lesser alloys are also suitable for handling these solvents in the pure state, the high-silicon irons are usually not applied unless other destructive chemicals are also present. Under these latter circumstances, Duriron and Durichlor have found extensive application.

Production of chlorinated solvents involves many severe services since free chlorine and free hydrochloric acid are commonly encountered along with the particular solvent. The destructive nature of moist chlorine and hydrochloric acid are well known and have necessitated the use of superior alloys for handling the solvents containing

(Continued)



Cut-away view of factory-lubricated Pierce torque converter transmission governor.



Left to right: F. C. Hess, Standard Oil lubrication specialist, W. E. Benjamin, Pierce Governor Company engineer, and A. C. Gartley, Standard Oil Lubrication Engineer, discuss vital part played by STANOLITH Grease in pre-lubrication of Pierce governors.

Elected for governor job...

TO INSURE trouble-free lubrication of their product in the field, officials of Pierce Governor Company, Inc., Anderson, Indiana, initiated the production of a factory-lubricated sealed unit type governor.

A special grease was found that did the job, but as production of the sealed units mounted, this grease became a costly production item. That's when STANOLITH Grease, recommended by a Standard Oil Lubrication Specialist, was tried. In test block runs simulating 10,000 hours of actual operation, at speeds ranging up to 4,000 RPM and temperatures from 150°F. to 200°F., STANOLITH did an even better job than the original lubricant.

STANOLITH factory-lubricated governors now have been in service for over eight months with no troubles resulting from bearing failures, overheating, or leakage of the lubricant. STANOLITH's lower cost has



been an added advantage.

This is one of many success stories reported by users of STANOLITH. For the beginning of your own lubrication success story, call your local Standard Oil (Indiana) office for the services of a lubrication specialist.

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

What's YOUR problem?



F. C. Hess, of Standard Oil's Indianapolis, Indiana, office, is the Standard Oil lubrication specialist who recommended STANOLITH to operators of the Pierce Governor Company, Inc., enabling them to make an appreciable cut in production costs.

Throughout the Midwest there is a corps of specially trained, experienced lubrication specialists ready to give you prompt, on-the-spot help with any lubrication problem. Each of these men has been carefully trained in a Standard Oil Lubrication Engineering School. It's easy to get the services of a lubrication specialist — just phone or write to your local Standard Oil Company (Indiana) office. When he stops by to see you, ask him about the following fine Standard products:

STANOL Industrial Oils—This general-purpose line of oils provides cleaner operation of hydraulic units and supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

CALUMET Viscous Lubricants—On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears, better internal lubrication of wire rope.

STANORUST Rust Preventives—The eight grades of STANORUSTs form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD OIL COMPANY (INDIANA)





Where Alkalies Destroy PRUFCOAT PROTECTS

The plant that manufactured the caustic soda in this storage tank is protected with Prufcoat, as are dozens of other alkali manufacturing plants throughout the country. (Names of these plants on request).

... Caustic Soda



Yes, in plants which actually manufacture caustic soda — the powerful stripper that eats up organic matter — as well as in plants producing mineral acids, organic acids and other alkalies, Prufcoat Protective Coatings have been providing positive protection against costly corrosion for over ten years now . . . on concrete floors, walls, ceilings, structural steel, pipes, tanks, ducts, machinery and equipment. Performance records in these chemical manufacturing plants, and in the process industries using their highly corrosive products, prove that where acids or alkalies destroy, Prufcoat Protects.

Coat for Coat, Prufcoat Gives More Protection at Lower Cost Than Any Other Air-drying Paint

Economical in original cost as well as in the preventive maintenance terms of positive protection against costly corrosion, Prufcoat Protective Coatings come ready-to-use in single, five and 55 gallon containers and are available in a wide range of attractive colors including green, buff, black, red, white, and several shades of gray.

An experienced Prufcoat corrosion engineer will gladly make a Preventive Maintenance Survey of your plant. No obligation, of course. Write today, describing YOUR corrosion problems.



New Prufcoat Metal-Reactive Primer P-10
... Does not require as complete surface cleaning as most other priming methods and works well on damp or dry surfaces. Makes possible a simple yet positive two-step system for corrosion-proofing old or moist metal surfaces . . . Write today for Prufcoat Technical Bulletin 012.

PRUFCOAT LABORATORIES, INC.
50 East 42nd Street, New York City

Preventive Maintenance PAYS

CORROSION FORUM, cont. . .

them as contaminants. Durichlor is particularly well adapted for this type service since it provides high resistance to both moist chlorine and hydrochloric acid at temperatures commonly encountered. Many plants are currently using pumps, valves and pipe in Durichlor for such processes with good success. However, before using Durichlor in these services it is recommended that the conditions of operation be carefully considered to assure complete success.

Application of the high-silicon iron alloys is not restricted to the manufacture of the chlorinated solvents since numerous conditions are on record where other solvents are encountered with the various mineral acids. Sulphuric acid and hydrochloric acid are commonly found in such mixtures. For instance, Duriron was used in the sulphonation of an alcohol where concentrated sulphuric acid was used. Very good resistance was obtained in this installation with the alcohol in no way lowering the resistance of Duriron to the acid. A Duriron fan is also providing very good service for handling carbon tetrachloride fumes in the presence of moisture. This service proved to be very corrosive to other materials formerly used.

Rubber Lining

J. P. McNAMEE, U. S. Rubber Co., Providence, R. I.

Aliphatic and aromatic solvents have an excessive swelling effect on both soft and hard natural rubber and GR-S compounds and should not be used in contact with these materials.

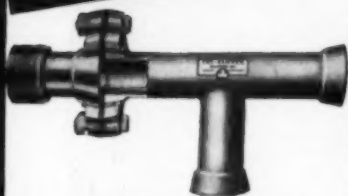
Neoprene linings are resistant to aliphatic hydrocarbons but are attacked by the aromatic types.

Buna-N type tank linings are extremely resistant to aliphatic solvents but are swollen by aromatics and are not satisfactory for use under service conditions which involve comparatively large quantities of aromatic hydrocarbons. Vapors of these solvents, particularly of the lower molecular weight types will accumulate in all of these rubber lining materials and cause swelling and failure of the bond.

Thiokol is an excellent solvent resisting material since it is unattacked by aliphatic hydrocarbons and only slightly swollen by even the lower aromatic solvents. It is suitable for the storage of such materials as high octane aviation fuel. Thiokol cannot be used under acid conditions, however, and since most applications where rubber linings are considered involve acids, the use of Thiokol as a tank lining is very limited. —End



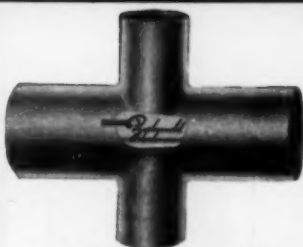
THE COMPLETE LINE



CONICAL END FITTINGS . . . Stainless Type 316—Inconel and other SS analyses. Complete line, sizes from 1 in. thru 4 in. O.D. Features: Light weight—low cost—fast installation—leak-tight—easily adapted to other fitting types. Covered in Catalog 848.



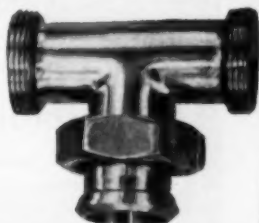
"ZEPHYRWELD"® WELDING FITTINGS . . . SS Type 304, 347 and 316—Inconel and other SS analyses. Fabricated in O.D. Tube Size, 1/2 in. thru 24 in.—elbs, tees, adapters, etc. Covered in Catalog 748.



SCHEDULE 5S and 10S WELDING FITTINGS . . . "Zephyrweld" SS Type 304, 347 and 316, full range of sizes from 1/2 in. thru 24 in. pipe, for use with Stainless light gauge pipe. Covered in Catalog 1051.



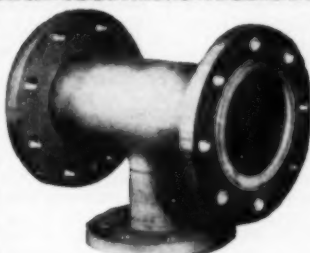
RECESSED-END FITTINGS . . . Stainless Type 304-347-316. Low cost, light weight fittings for fast, simple soldering, brazing or socket welding. Sizes from 1/2 in. thru 24 in. Full line of elbows, tees, adapters, etc. Covered in Catalog 948.



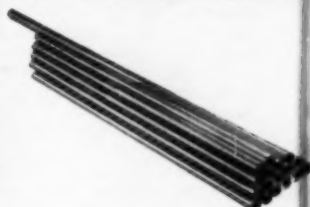
SANITARY TYPE FITTINGS . . . Stainless Steel and Tri-Alloy (Nickel Alloy), from 1 in. thru 4 in. O.D., full range of fitting types. Approved as meeting 3A Standards throughout, incorporating exclusive design features. Covered in Catalog 150-B.



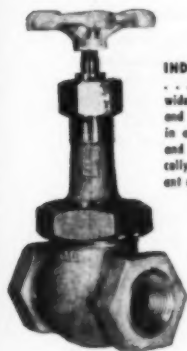
SCREWED FITTINGS . . . Stainless Steel Type 304-347-316. Complete range of fitting types. Meets the demand wherever flanged and screwed fittings are required. Clean-cut, accurate I.P.S. threads. Covered in Catalog 451.



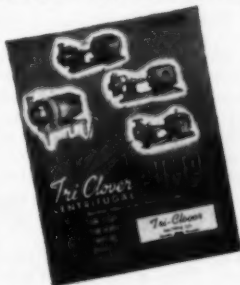
PREFABRICATED FITTINGS . . . such as this butt-welded, flanged assembly, available in a wide range of types and sizes to meet special requirements.



STAINLESS STEEL TUBING AND PIPE . . . a most complete line, in all popular stainless analyses, wide size range, polished or unpolished.



INDUSTRIAL VALVES . . . Tri-Clover offers a wide selection of standard and special design valves in a wide range of types and sizes to meet practically every corrosion-resistant requirement.



NEW PUMP CATALOG 250 . . . contains complete pump data never before published—covers the full 1951 Tri-Clover Pump Line for every application. Write for your copy now.

● Here you see representative fittings, valves, pumps, tubing and pipe that go to make up the *complete* Tri-Clover line—all available from *one* source. Install these stainless steel or alloy products in your process lines and realize the advantages of increased production and lower maintenance cost. 32 years of specialized experience in solving corrosion piping problems can be yours by consulting our engineers.

Write for details, or see your nearest Jobber.



TRI-ALLOY AND STAINLESS STEEL
SANITARY FITTINGS, VALVES,
PUMPS, TUBING, SPECIALTIES

FABRICATED STAINLESS STEEL
INDUSTRIAL FITTINGS AND
INDUSTRIAL PUMPS

THE COMPLETE LINE



Don't Pass Up That Chance to Talk

Even if your "public speaking" is limited to the telephone, or to a few words at an occasional conference, here are some tested tips that you can profit from. Engineers have ideas to sell, just as salesmen have commodities.

HERMAN W. SEINWERTH

In his first inaugural address, George Washington was so visibly perturbed that his hand trembled, his voice shook, and he could scarcely be understood. His bravery was unquestioned on the field of battle but he was terrified while making this speech. Stage fright, platform jitters, nervousness, call it what you will, has caused more anxious and fearful moments than any field of battle.

George Washington revealed a few of the symptoms. You may have experienced some yourself; knees quaking, teeth chattering, heart pounding, etc., etc. If so, you have plenty of fellow sufferers.

Yet it is all so unnecessary. Washington later learned to control his emotions. You can control yours by properly directing your nervous energies. That is, you can if you really want to badly enough.

Here are some practical tips to help you. No magic, no bunk, just a few common-sense principles based on actual platform experience.

Six Ways to Banish Stage Fright

DEFINE IT

Stage fright is generally misunderstood.

HERMAN W. SEINWERTH is Manager of Industrial Relations for the A. C. Lawrence Leather Co. His basic, hard headed advice to the speaker is among the best we have seen in a long, long time.

stood. Nearly all good speakers will tell you that a certain degree of nervous excitement is necessary if one is to do his best. A pounding heart, a fluttering stomach, are usually only signs that the speaker is on edge, ready to do his best. Your task is to utilize the nervous energy thus revealed as a springboard to an enthusiastic presentation instead of allowing such nervousness to degenerate into fright.

CONFESS IT

Admit your nervousness. Don't try to hide it. It is a natural reaction and you complicate your difficulties if you deliberately repress it. Most of us feel better just by getting such a thing out in the open. Ridicule your fears. Minimize the emergency you face.

PREPARE FOR IT

Borrow a lesson from the Boy Scouts—Be Prepared! Nothing is more important than preparation and practice. Master your subject. Get excited about it. Believe in it.

Use a speech formula to sort your ideas. Never memorize. As you practice your talk aloud you will find that each time you are phrasing it differently. This helps to achieve ease of expression when on the platform.

Prepare well and Practice! Practice! Practice!

FACE IT

Act as if you are unafraid. Put on a bold front. Take a tip from Clyde

Beatty, the great animal trainer. He looks his animals right in the eye, never by word or act, admitting the slightest fear. Have faith in yourself and the audience will rarely sense any nervousness.

Face your fears. Wade right in and do your best. Most soldiers are afraid, even terrified, when under fire for the first time. They go forward regardless and soon have no time to be afraid. Try that when you speak. It works!

OVERWHELM IT

Relax! It is impossible to be relaxed and nervous at the same time. Try to relax just before you talk.

Jack Dempsey steadied himself before each fight by deep breathing. This helps to adjust the blood circulation.

Smile! Be pleasant! Start in a pleasant and gracious manner.

Think of the audience as ordinary folks, not supermen. Most of them envy your ability to speak to them.

ROUT IT

Seize every opportunity to speak. Build your confidence by a series of successes. Each time you successfully speak before a group of people, you have topped another hurdle. The longest journey begins with a single step, so start tonight at the PTA meeting, or the next society meeting you attend. Stand up and make some comment from the floor.

George Bernard Shaw was petrified with fear at the thought of speaking before audiences in his earlier days. He determined to overcome his fear so he began visiting meetings of all kinds. At every one he would find some pretext to stand up and comment. It worked!

You cannot learn to swim from a book. You must get in the water. The same is true of public speaking. You cannot gain ease and confidence before an audience unless you appear before audiences. Do it often.

Putting Your Points Across

So much for adjusting yourself to the podium. Now what about your material? The speaker knows that confidence and enthusiasm do not "just happen." They are the direct result of preparation, practice and conviction.

PREPARATION

Dale Carnegie recommends this "sure-fire" formula to the would-be
(Continued)



LUNKENHEIMER Shoulder-Less Steel Valve Seat Rings...

- CAN'T WEDGE OUT OF PLACE
- SEAT TIGHTER WITH SERVICE
- ASSURE GREATER BODY STRENGTH
- WILL NOT WARP
- EASILY RENEWABLE

Notice how the inner facing of the Lunkenheimer ring seats squarely against the body wall. There's no flange or shoulder where corrosion can work its way inside — no bending that causes leakage.

This end-seated Lunkenheimer ring *stays put* — won't warp out of place or twist away from the body as it is tightened. See how firmly the heavy ring seals itself into the wall, becoming an integral part of it, adding *extra* strength at the "nerve center," guarding against corrosion.

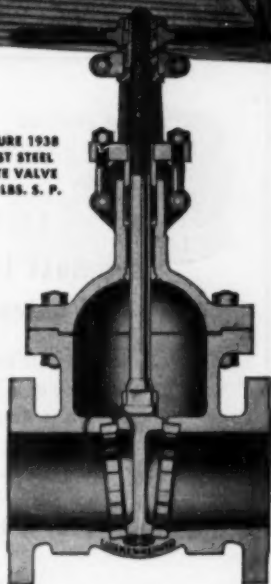
And this ring actually seats more tightly with years of wear.

Should you ever need to replace it — heavy lugs inside the ring make renewal simply a matter of screwing the old one out, the new one in . . . quickly, without serious production delays.

Before you approve that next order for steel valves in your plant, be sure to double-check seat ring construction. For longer life and lower maintenance costs, specify Lunkenheimer steel valves . . . with *shoulder-less* seat rings.

Write today for your copy of "Lunkenheimer Cast Steels," an informative 52-page brochure on the development and application of steel valve alloys. The Lunkenheimer Co., Box 360P, Cincinnati 14, Ohio.

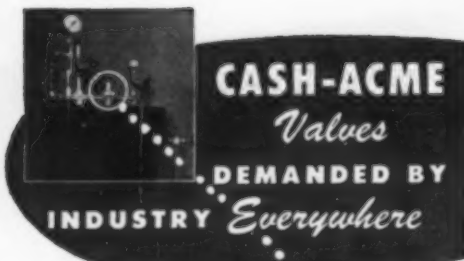
FIGURE 1938
CAST STEEL
GATE VALVE
300 LBS. S. P.



STEEL • IRON • BRONZE

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES



Type "B" Pressure Reducing and Regulating Valve

steam generator
manufacturer specifies

CASH-ACME

When the pressure's on, this steam generator manufacturer depends on a CASH-ACME Automatic reducing and regulating Valve for unfailing service. It's the same story in any industry that requires consistent pressure control. CASH-ACME is specified by more and more manufacturers. Write today and find out how a CASH-ACME Automatic Valve can help with the successful operation of your product.



Bloomington, Ill.

A. W. CASH VALVE
MANUFACTURING CORP.

6614 E. Wabash Avenue
Desatur, Illinois



there's an
E&D
FILTER PAPER
for most filtration problems
of science or industry



As manufacturers of filter and absorbent papers we gladly place at your disposal our experience and skill in helping you select the proper paper for the problem confronting you. Or, if a new kind of paper is indicated, chances are we can produce it for you. Call on us without any obligation.



YOU AND YOUR JOB, cont. . .

speaker: "Prepare well." Proof that he follows his own advice is the fact that his radio programs required an average of 60 man hours of preparation for each 11½-minute broadcast. Think of it. That means he could have gone over his talk more than 300 times, and Dale Carnegie was no beginner like you or me.

Of course most of us cannot afford to spend that much time on a talk but if we follow such examples to the best of our ability we cannot fail to be successful.

Work hard on your talks. No really good presentation was ever prepared quickly or easily. Develop a lot more material than you can possibly use.

Specifically define your purpose. Know exactly what item, idea, or plan you are trying to sell. Know how much, which way, etc.

Do not try to do too much in one talk. It is far better to sell one point well than half sell several.

Review other factual data furnished by the company—sales bulletins, laboratory results, advertising materials, etc. Then there are always the exhaustive resources of the library. Carefully select specific examples and appeals that will most effectively serve the particular objective you have in mind, considering audience, situation and timeliness.

Organize your presentation utilizing a proved speech formula. Some wag has said, "Far too many speeches are like the horns of a bull—a point here, a point there, and a lot of bull in between." Habitual use of a formula will help you avoid talks with a lot of bull.

PRACTICE

After your talk has been carefully prepared in outline form—Practice! Practice! Practice!!! The old saw that "Practice makes perfect" pays real dividends. Build confidence and increase effectiveness by practicing the delivery of your talk aloud as often as possible. Here are a few practical tips:

Method—Practice in front of a mirror. See yourself as others see you. Time yourself. Eliminate unnecessary material. Make every word count. Smooth the transitions from one formula step to the next. Integrate the whole talk for most effectiveness.

Memorization—Do not memorize! A memorized talk is always easily recognized because it cannot be delivered naturally and with personal conviction. It is so easy to forget a word or two and so lose the whole train of thought. By practicing your talks aloud from an outline you will naturally use different word and sentence
(Continued)

which centrifuge for *your* process?

*the complete line of SHARPLES continuous centrifuges . . .
your assurance of unbiased recommendations*

Does your process involve the continuous separation of two immiscible liquids? Must you remove or recover large quantities of solids from slurries, or dehydrate crystals? Is there some valuable by-product which it would pay you to recover, if processing could be done continuously and economically?

In the complete line of Sharples continuous centrifuges . . . you will find the centrifuge best suited to your particular clarifying, separating, or classifying job. Sharples gives you the complete choice. *It will pay you to investigate.*

SUPER CENTRIFUGE

Highest centrifugal force commercially available (13,200 x G) is developed by this tubular bowl continuous centrifuge. Easy to clean, it can be used to separate immiscible liquids with small differences in specific gravity or to effectively clarify liquids.



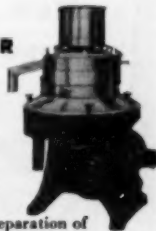
D-2 CENTRIFUGE

This disc type, continuous centrifuge utilizes the stratification principle which is most effective in concentrating a liquid or solid phase suspended in another liquid.



NOZJECTOR

Solids are continuously discharged from the disc type bowl of this high efficiency centrifuge which is widely used for separation of two immiscible liquids containing solids, or for the concentration of solids in a liquid phase.



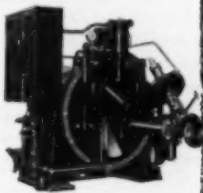
DV-2 CENTRIFUGE

Solids ranging from firm to slimes and sludges are handled by this versatile centrifuge, with continuous solids discharge. Available as a clarifier to remove solids from liquids; or a separator, to separate two immiscible liquids in the presence of solids.



SUPER-D-HYDRATOR

An extremely flexible, completely automatic centrifuge for recovery and dehydration of crystals. Efficiently handles slurries with 15 to 60% solids. Each step of feed, rinsing and drying can be individually controlled.



SUPER-D-CANTER

High capacity centrifuge for removal of solids from liquids . . . clarification of liquids . . . classification of solids. Available in two bowl types to accommodate wide range of solids consistencies.



Our Engineering Staff is always available to you. Feel free to call on their experience to analyze your needs and recommend the centrifuge that will do your job BEST.

SHARPLES



THE SHARPLES CORPORATION • 2300 WESTMORELAND STREET, PHILADELPHIA 40, PENNA.

NEW YORK • BOSTON • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON

EXTRA

DAILY BULLETIN

ANOTHER NATIONAL FIRST

New **AER-O-FOAM "99"**
Smother's **POLAR SOLVENT** Fires



The 5-gallon AER-O-FOAM "99" container is readily identifiable by its distinctive yellow and red label to distinguish it from other types of foam.

AER-O-FOAM "99" . . . new liquid type mechanical foam! Now get positive, quick-acting protection on fires involving polar solvents or petroleum products.

When applied to fires fueled by polar solvents such as methyl, ethyl, isopropyl alcohols, esters, ketones and ethers as well as petroleum products, AER-O-FOAM "99" offers new, dependable, stabilized protection. It is easily generated. Provides smothering, closely-knit blanket of fire-killing foam. Will not readily disintegrate or break down. Thoroughly tested, it is easily applied with existing 6% devices.

CHECK THESE ADVANTAGES:

- ✓ Complete protection in automatic systems
- ✓ Simplified storage in tanks
- ✓ Wide choice of application devices

WRITE FOR DETAILS

For further information, see your nearest National Foam Distributor, or write for complete details today!

ANOTHER NEW PRODUCT BY NATIONAL FOAM
—Pioneers in the manufacture of foam and foam equipment

NATIONAL FOAM SYSTEM, INC.

Headquarters for Foam Fire Protection
WEST CHESTER, PENNA.



YOU AND YOUR JOB, cont. . .

construction each time, and thus build your confidence through versatility.

Recording—Occasionally make a 25 c. recording of your presentation. You will thus be able to hear how you sound and you can criticize and strive to improve weak points.

CONVICTION

A successful executive says that whenever a salesman tries to sell him he usually makes up his mind in the first minute or two. How? By the impression he gets from the salesman's approach and attitude. He can't afford to waste time listening to a man trying to sell without conviction.

Never attempt a talk unless you have sold yourself by adequate preparation and practice. Then be sure that you are physically and mentally alive. Get excited about your message! Believe it! Sell it! Enthusiasm is contagious. Make sure your audience catches it.

Your Voice Is You

Next and last point is your voice. Do you realize the extent to which your voice portrays you? Does it do you justice? Is it relaxed and pleasant or is it nasal and irritating?

Telephone and radio, force reliance on voice alone to achieve the speaker's purpose. There are no really "bad" voices, but many voices are not "used effectively." You have the makings of an effective voice personality, but it is up to you to do something about it.

To this end, let us focus our attention on eight practical tips to make our voices pleasing, easily heard, and distinct.

KEEP YOUR NECKTIE HIGH

Posture is all important. Stand straight and tall. Do not restrict breathing by cramping the lungs. Give your voice easy exit.

BREAK THAT TENSION

Relax! A tense, strained voice is never pleasant to hear nor easy to use. Breathe deeply. Use relaxation exercises. A simple one is to roll the head to loosen the neck and throat muscles.

LEARN TO BREATHE EFFECTIVELY

It may seem strange to tell you to learn to breathe properly, but for the speaker, shallow breathing spells disaster. Breathe from the bottom of the diaphragm. When expelling the breath, conserve and direct it to put "punch" behind your words.

VITALIZE YOUR WORDS

Be alive! Feel what you say! You cannot expect your message to be
(Continued)

TRADE PAPER EDITION

Published by
SCHUTTE and KOERTING
Company



ENGINEERING

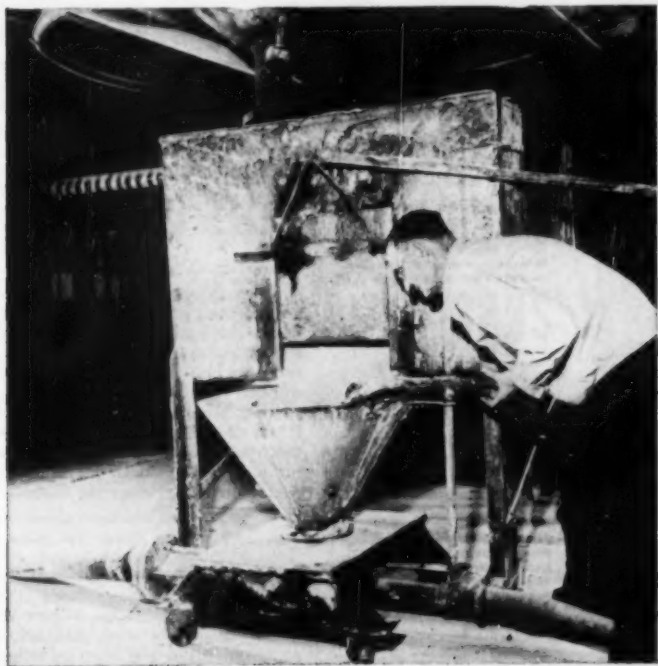
News

KEY APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSING AND THERMOCouples • OIL BURNING EQUIPMENT
VALVES • FLOW MEASUREMENT • ELECTRIC TESTS • TANKS • PUMP MOUNTS • AND OTHERS • SEE LIST PAGE 10

Novel Portable Unit Conveys Spent Clay From Sun Plant

Sun Engineers Mount SK Hopper Eductor On Rolling Platform To Solve Handling Problem

(Illustration and Story by Courtesy of Sun Oil Company)



At International Harvester Company's West Pullman Works, SK Rotameters, mounted on panels as shown in the photo, are used for test

checking carburetors of various engines made by the company. The carburetors are installed in snap-jigs and are tested at low and wide-open flow—which corresponds to idling and full-speed operation. The Rotameters are used to check the air and fuel consumption. Since this is a production operation involving the checking of thousands of carburetors, instruments which would indicate almost instantly were necessary. The SK Rotameters, after installation, met all specifications for both speed and accuracy. For information on SK Universal Rotameters for panel mounting, request Bulletin 18-RB.

WITH the arrangement shown in the photo, engineers at the Marcus Hook, Pa., Refinery of Sun Oil Company neatly solved a materials handling problem and materially decreased the time required to convey spent clay from several filter shells to a settling basin outside the building.

They mounted a standard SK Fig. 254 Hopper Type Eductor on a movable platform in such a way that the hopper is located above the platform and the eductor proper below. Flexible pressure and discharge hose connections are used.

When it becomes necessary to remove spent clay from any one of ten filter shells, a movable secondary drum, or hopper, is rolled under the man-head of the filter shell and the spent clay is dropped into this. A manually operated gate in the secondary hopper is regulated to permit the proper amount of clay to feed into the eductor hopper.

Pressure water, by-passed from the inlet line on the eductor, issues through the secondary spray nozzles in the eductor hopper and washes the clay down into the eductor chamber. Pressure water, issuing through the nozzles of the eductor entrains the clay and discharges through the flexible hose with sufficient force to carry the clay-water slurry to a settling basin outside the building.

This is but one of many ways a wide variety of standard eductors manufactured by SK have been applied by ingenious engineers in a variety of industries. For facts and figures on all types of eductors and for ideas and suggestions concerning their use, request Bulletin 2-M.

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YOU AND YOUR JOB, cont. . .

vibrant unless you are enthusiastic.

Be conversational! Smile frequently! Never orate. If you begin to lose your naturalness as you speak, pause a moment and say to yourself, "Now look, Ed, this is the story. . ." This simple trick will keep you talking with your audience and never at nor down to them.

USE YOUR NATURAL VOICE LEVEL

To find it try this simple exercise. Start counting in a whisper. At number 6, gradually come out of the whisper and speak aloud. If you do this without forcing the sound you will always hit your normal level. Continued use of an unnatural pitch is irritating to speaker and audience alike.

STAY WITHIN SPEED LIMITS

The average speaker uses words at the rate of about 135 per minute. If your rate is less than 90, you will bore your audience. If it is more than 160 you are talking too fast for them to keep up with you. Check your voice speed. Adjust and vary the rate to inject animation in your words.

NO PERPETUAL MOTION HERE

Pauses are punctuation tools. Clear-cut punctuation at the end of sentences adds to effective delivery. Avoid connecting every sentence with er's and uh's, etc. These common "word whiskers" mar the delivery of many speakers but can easily be eliminated if you make the effort. When a sentence is completed, stop and say nothing until you are ready to begin the next sentence. Pauses are dramatic. Use them.

DON'T GARBLE

Carefully enunciate each word. Do not slur or telescope syllables and words. See that the last syllable especially is clearly articulated before going on to the next word. Practice enunciation with tongue twisters. Watch your lips in a mirror. Is your mouth open? Are your jaws, lips, and tongue cooperating? Put them to work.

Make occasional recordings of your voice, then listen to the records. Criticize your voice and strive to improve it.

In your voice you have one of the most marvelous machines in the world. Treat it well. Spend some time each day reading aloud to someone, practicing and applying the tips listed above. You will be amply rewarded by a better voice personality which will help you achieve greater success.

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SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in petroleum products, pro-

duction and refining. Under the Sinclair Plan, the available capacity of these great laboratories is being turned over to work on the promising ideas of independent inventors everywhere.

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*The Sinclair Plan is opening up the Company's great laboratories
to every American who has an idea for a better petroleum product*

INVENTIVE Americans are often at a loss today. Not because of any lack of ideas, but because of a need for expensive facilities to find out if and how their ideas work.

This was no obstacle in our earlier days. The Wright Brothers designed their first airplane with the help of a foot-square home-made "wind box"—and the plane flew.

In contrast, the man with a new idea in airplane design today often needs a super-sonic wind tunnel costing millions.

In short, science and invention have become so complex that a man with an idea for a better product often needs the assistance of an army of specialists and millions worth of equipment to prove his idea has value.

Within the petroleum field, the Sinclair Plan now offers to provide that assistance.

Under this Plan, Sinclair is opening up its great research laboratories at Harvey, Illinois, to independent inventors who have

sufficiently good ideas for better petroleum products or for new applications of petroleum products.

If you have an idea of this kind, you are invited to submit it to the Sinclair Research Laboratories, with the provision that each idea must first be protected, in your own interest, by a patent application, or a patent.

The inventor's idea remains his own property

If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple arrangement with you: In return for the laboratories' investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea for its own companies, free from royalties. This in no way hinders the inventor from selling his idea to any of the hundreds of other oil companies for whatever he can get. Under the Plan, Sinclair has no control

over the inventor's sale of his idea to others, and has no participation in any of the inventor's profits through such dealings. Moreover, it is a competitive characteristic of the oil business that the new products adopted by one company are almost invariably adopted by the whole industry. This means that the very fact of his agreement with Sinclair should open up to the inventor commercial opportunities which might otherwise be hard to find.

How to proceed: Instructions on how to submit ideas under the Sinclair Plan are contained in an Inventor's Booklet available on request. Write to: W. M. Flowers, Executive Vice-President, Sinclair Research Laboratories, Inc., 630 Fifth Avenue, New York 20, N. Y. for your copy.

IMPORTANT: Please do not send in any ideas until you have sent for and received the instructions.

SINCLAIR—A Great Name in Oil



MAN OF THE MONTH: Robert C. Swain

New honorary chairman, American section, Society of Chemical Industry—vice president, research and development, American Cyanamid.

Robert C. Swain spent his first 21 years in Palo Alto, Calif. His father, a renowned chemist, was for many years head of Stanford's chemistry department and acting president of the university.

Young Bob's student days at Stanford won him not only an A.B. but also a college letter as a two-miler in track. A

natural athlete, he's still collecting trophies—these days it's for golf. And he squeezes into his schedule just as much tennis, hunting and fishing as his business activities will allow.

When he did leave his home town in 1928, he lived up to the reputation of his forty-niner grandparents. They had crossed the plains during the gold-rush days. Dr. Swain crossed a continent and an ocean to study at the University of Heidelberg. He went on to get his Ph.D. through an Alexander Von Humboldt fellowship at the University of Berlin, then back to Stanford for two years as a National Research Fellow.

In 1934 he joined Cyanamid and worked for eight years as a research chemist. He became director of the research division at Stamford Laboratories in 1942, research director of the company in 1945, vice president in charge of research and development and a director of the company in 1946. He's also a director of Jefferson Chemical Co.

His activities on behalf of his profession have been both national and international in scope. He has served the United States: as consultant to the Office of Scientific Research and Development 1943-45; as chairman of the committee on chemical warfare, Research and Development Board, Department of Defense; as a member of the panel on the nation's potential for basic research in chemistry; as a member of the National Research Council's executive committee, division of chemistry and chemical technology. He is directing the work carried on by his company in connection with contracts with the AEC. This work is entirely on a non-profit basis.

On an international scale, he's been: member of U.S. delegation and member of the council of International Congress of Pure and Applied Chemistry, London, 1947; vice chairman and now honorary chairman, American section, Society of Chemical Industry.

Despite this heavy schedule of business activities, quiet, reserved Bob Swain is very much a family man. He married Frances Grace Johnson in 1929 and is the father of three children: Mary, 20, a student at Wells College; Robert, 17, at Deerfield Academy; Nancy, 15, at Greenwich Academy. Their home is in Riverside, Conn.

Thomas H. Chilton. Recipient of a certificate of service, ASA; has been member of the Standards Council representing AIChE. President of AIChE. Director of development engineering, Du Pont.

George H. Law. Director of research, Carbide and Carbon. Started research work with Carbide in 1929. Graduate of Lehigh, Ph.D. New assistant director of research; **Franklin Johnston.** Research group leader at company's South Charleston laboratories since 1938; with Carbide since 1933. Graduate of Penn State, Ph.D.

Harry E. Roche. From manager of the production department, Kopper's chemical division, to special duties in connection with design and construction of division's new

Williams plant at Port Arthur, Tex. His successor: **A. A. Sellers,** former manager of the division's Kobuta styrene and polystyrene plant at Monaca, Pa. Sellers' successor: **Bernard R. Sarchet,** who also continues in charge of the reactivated government-owned butadiene plant at Kobuta.

Hugh S. Taylor. To present the 1951 Remsen Memorial Lecture of the ACS Maryland section. Dean of Princeton's graduate school; former chairman of its department of chemistry. Now active in the program in chemical kinetics at Princeton's new James Forrestal Research Center. Came to the university in 1914 as an instructor in chemistry. Studied at Liverpool University, Nobel Institute of Stockholm, Technische Hochschule, Hanover, Germany.

Ernest W. Reid. To receive the Chemical Industry Medal for 1951 presented by the American section of the Society of the Chemical Industry. President of Corn Products; with company since 1943. Previously with Mellon Institute and Carbide & Carbon.

Z. W. Bartlett. Assistant general manager, southern operations, Freeport Sulphur. General superintendent, Hoskins Mount plant; **B. A. Axelrad.** Administrative superintendent; **L. E. Bumgarner.**

LeRoy W. Clemence. From group leader in organic research to administrative assistant to the director of research, Abbott Laboratories, North Chicago, Ill. Graduated in chemistry from the University of (Continued)

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NAMES IN THE NEWS, cont. . .

Pennsylvania, 1926; joined Abbott. Elmer O. Krueger: from assistant manager to manager, control laboratories. Louis F. Reed: assistant manager, patent department. Started with Abbott as a chemist in 1940; transferred to patent department, 1946. Studied chemistry at Iowa State, law at Loyola.

Elliot Schrier, CE's new western editor, decided to prepare for a career as a technical writer and editor while a junior at Michigan State. After winning his degree in chemistry in 1948, he went on to Stanford to get another degree in literary criticism. He remained there doing advanced work in physical chemistry until this June.



Interspersed with his schooling he held such part-time and temporary college jobs as graduate assistant in chemistry and non-rotational inorganic analyst.

Having a reserve commission in the Army (30 months with the Infantry in the Pacific during World War II) he spent last summer earning paratrooper wings. His hobbies are swimming, skiing (novice class, he says) and miniature photography.

M. H. Thornton. Chairman of the chemistry division, Midwest Research Institute. Joined institute in 1946 as staff member.

Edward B. Seaton. Assistant to the director, Monsanto's general development department. To be resident technical representative in Europe, headquarters in Paris. Has been doing chemical engineering work for the department. Joined Monsanto in 1941 as an analytical chemist. Studied at Case Institute of Technology and the University of Virginia.

Julian Glasser. Technical aide on titanium and zirconium research in a new metallurgical unit of the National Research Council. On leave as physical chemist, Armour Research Foundation. With the foundation since 1947. Formerly-director of research, General Abrasive Co.; chief chemist and metallurgist, Tacoma Aluminum Reduction plant.

John A. Hassinger. Manager of the newly formed Pfizer, Canada, Ltd. Has been assistant district manager for Pfizer. Previously with E. R. Squibb and Lederle Laboratories.

Warren O. Erickson. To work on polyester-type resins for technical department, Plaskon Division, Libbey-Owens-Ford Glass Co. Has been research and technical supervisor for Northern Regional Laboratory, U. S. Department of Agriculture. Other jobs: with the field research division of Socony-Vacuum; with the paint division, Pittsburgh Plate Glass; instructor of organic chemistry, University of Wisconsin.

George Granger Brown. Dean of the college of engineering, University of Michigan. On the faculty since 1920 as instructor in chemical engineering, assistant professor, associate professor, professor, Edward DeMille Cambell University Professor of Chemical Engineering. Studied at NYU and the University of Michigan.

J. V. Hightower. Assistant manager, Washington, D. C., office, Ralph M. Parsons Co. Formerly, western editor, Chemical Engineering. With McGraw-Hill since 1945.



J. V. Hightower



P. S. Williams

P. S. Williams. Vice president, California Spray Chemical Corp., Richmond, Calif. Has been manager of the manufacturing department since 1947. Graduate of Stanford. Started as chemical engineer with Standard Oil of California in 1921; liaison officer between Standard and Cal-spray, 1932-40; transferred to Cal-spray as plant manager of its two Richmond plants.

Frederick D. Rossini. Member of the National Academy of Sciences. Professor, head of the chemistry department, director of the petroleum research laboratory, Carnegie Tech. From 1936-1950, chief of the thermo-chemistry and hydrocarbons section, National Bureau of Standards. Winner of the Hillebrand Award, 1934. Graduate of Carnegie Tech.

W. N. Williams. Operating vice president, Westvaco Chemical Division, with headquarters at New York. With Westvaco and its predecessors

(Continued)



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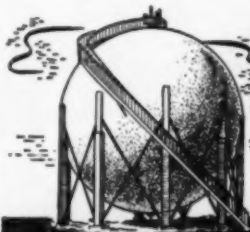
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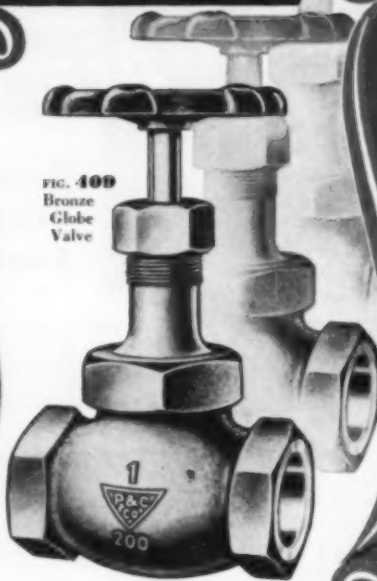
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NAMES IN THE NEWS, cont. . .

for 20 years as: manager of the Barium Products, Ltd., plant at Modesto, Calif.; manager of western operations at Newark, Calif.; vice president, production, at New York. His staff assistants: **K. C. Rule**, formerly assistant production manager at New York; **R. J. DeLargey**, recently assistant general manager, Grove Regulator Co., Oakland, Calif.

R. Norris Shreve, a member of the Engineering Faculty of Purdue University, Lafayette, Ind., since 1930 will give up the Headship of the School of Chemical and Metallurgical Engineering September 1 to resume his professorship of chemical engineering. He will devote his time to his teaching, professional contacts, research and writing. Professor Shreve came to Purdue University in 1930 following over twenty years of broad engineering and industrial experience in designing, building and operating plants in the chemical industry. While at Purdue, Professor Shreve has written four books as author or co-author and some seventy technical articles. One of these books, "Chemical Process Industry," has had a sale of 31,000 copies over six years and has been translated into Spanish and is being translated into German.



Professor Shreve will be succeeded as head of the school by Edward W. Comings from the University of Illinois. Dr. Comings is not a stranger to the Purdue campus as he taught in the School of Chemical and Metallurgical Engineering for three summers.

Eric G. Snyder. Vice president of Takamine Laboratory, Clifton, N. J. Continues in charge of research and development, production and sales. New plant manager in charge of production: **Herbert B. Uhl**. Formerly with Heyden Chemical Corp. as superintendent of their fine chemicals plant. Graduate of Penn State.

Leland H. Burt. Supervisor, product development, cellulose products department, Hercules. Joined Hercules in 1942 as a product supervisor in the department; named supervisor of cellulose gum development in 1949.

Herbert B. Sliger. From assistant general sales manager to manager of the purchasing department, Commercial Solvents. With the company since 1927. Graduate in chem-

(Continued)

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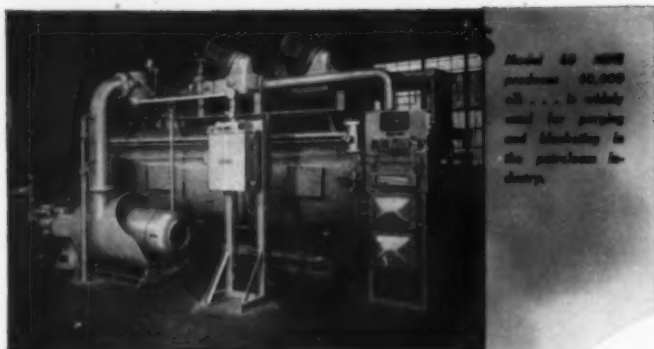
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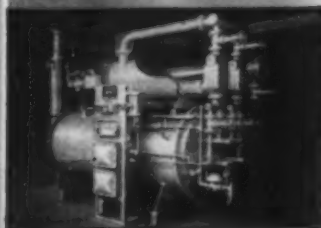
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NAMES IN THE NEWS, cont. . .

ical engineering from Rose Polytechnic Institute.

Sidney N. Sadoff. Vice president in charge of engineering, Schenley Laboratories. Has been special project engineer then chief engineer for Schenley since 1946. Formerly with Shell Development Co., San Francisco.

Carlton F. Zimmerman. From chief control chemist to technical director, Amer Co., Buffalo. With Amer nine years. Formerly with Stauffer Chemical.

S. Philip Marcus. Assistant production manager, Westvaco, with headquarters in New York. Previously assistant to the manager of the company's South Charleston, W. Va. plant. New member of Westvaco's production staff at New York: **Robert A. Bondurant, Jr.** Formerly executive vice president of Michigan Chemical Corp., St. Louis, Mich.



S. P. Marcus



G. A. Perkins

Granville A. Perkins. Vice president in charge of research, Carbide and Carbon. Has been director of research since 1944 in charge of Carbide's extensive research laboratories at South Charleston, W. Va. With the company since 1929. Graduate of Cornell and the University of Pittsburgh.

Harmon E. Keyes. Special consultant, technical staff, Inflico Inc., Tucson, Ariz. Active for 26 years in research and development of copper extraction processes, particularly production of ferric sulphate and sulphuric acid on a commercial scale.

James W. Dunham. President of the International Acetylene Assn. Vice president, director and chairman of the executive committee, National Cylinder Gas Co., Chicago. Director of the Midwest Carbide Corp., Tube Turns and Pennsylvania Forge Corp.

James Bailey. Winner of the 1950

July 1951—CHEMICAL ENGINEERING

John Wesley Hyatt Award for distinguished achievement in plastics. Vice president and director of research, Plax Corp. With company since 1937. Some of his developments: techniques for the production of polyethylene bottles; continuous extrusion of flexible polystyrene sheet; extrusion in continuous lengths of rod of cellulose plastics and polymeric resins. Lehigh graduate.

Charles H. Schroeder. Technical manager of textiles, industrial products division, B. F. Goodrich. Joined company in 1921 as research chemist; technical man in the general molded goods department for past five years. Studied chemistry at Oberlin and Toledo University.

Frederick C. Nachod. Chairman of the eastern New York section, ACS. Director of the physical chemistry laboratories, Sterling-Winthrop Research Institute, Rensselaer, N. Y.

Reuel C. Stratton. Member of the AEC hazards survey group which is directed toward the possible further establishment of nuclear reactors closer to existing communities. Supervising chemical engineer of Travelers Insurance Cos., Hartford, Conn.

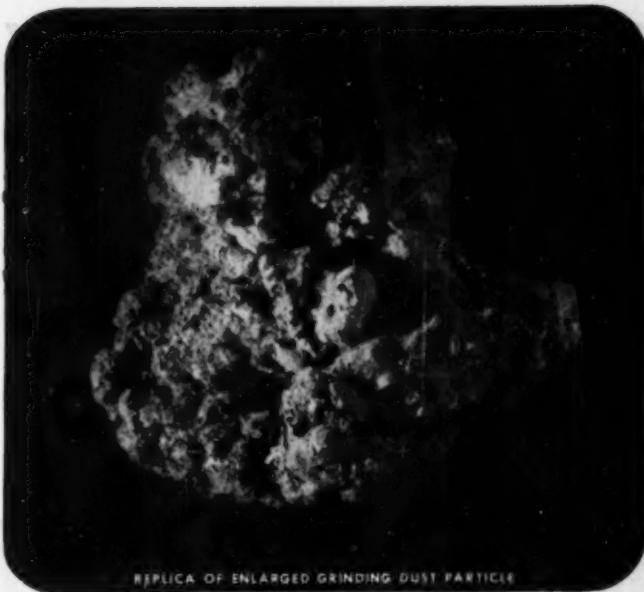
Mario Castillo. Chief development engineer, Alfred Bicknell Associates, Cambridge, Mass. Graduate of Columbia, 1942 (M.A. in chemistry). Previous jobs: in experimental research at Oak Ridge; on the research staff of MIT; in private consultation in instrument design and development.

Harry L. Ericson. Chief chemist, Continental Carbon's new Amarillo, Tex., laboratory. Previously associated with Witco Chemical's research laboratories in New York and Chicago. Chemical engineering graduate of Northeastern. New technical supervisor: T. A. Ruble. Formerly with the research department of Phillips Petroleum. Graduate of Purdue.

N. N. Dalton. Retired as research director of the Assn. of American Soap & Glycerine Producers, New York, after 25 years in the post. An executive with Colgate-Palmolive-Peet and its predecessors prior to 1934. During World War II: chief of the glycerine division, WPB.

F. B. Menger. Associate director of
(Continued)

CHEMICAL ENGINEERING—July 1951



REPLICA OF ENLARGED GRINDING DUST PARTICLE

TROUBLE—MAGNIFIED 3000 TIMES!

Ever wonder why some machines require excessive maintenance? Why they are not as accurate in performance as they are rated?

One vital answer is *abrasive dust*. When uncontrolled, it can attack bearings and other precision machine parts with damaging effects—creating abnormal wear and "sloppy" operation. In addition, safety engineers have long recognized the hazards of abrasive dusts to workmen.

Uncontrolled dust of any type in manufacturing or processing not only is troublesome but becomes a costly problem by reducing operating efficiency of both men and machines.

DRACCO DUST CONTROL EQUIPMENT—backed by over 35 years engineering and manufacturing experience exclusively in dust control—can remove this hazard from your operations. DRACCO engineers will gladly provide you with complete data on high-efficiency DRACCO equipment as applied to your specific problem. Simply write to



DRACCO CORPORATION

4063 E. 116th St., Cleveland 5, Ohio or
415 Lexington Avenue, New York 17, N. Y.

AGENTS IN PRINCIPAL CITIES

DRACCO *Performance Proved*
DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

SUPERIOR EFFICIENCY IN FUME AND ODOR CONTROL SHOWN BY TEST

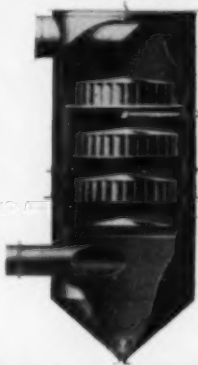
The outstanding efficiency of the Multi-Wash system in the paint, varnish and lacquer industries has been substantiated by a recent 3 months test by a mid-west association representing these industries.

The equipment was tested on varnish kettles with a maximum of 1000 c.f.m. output of fumes. The material tested was long oil linseed phthalic alkyd at the highest temperature of 475°. The next test was with tall oil esterified with glycerine at 570° temperature. On both tests Multi-Wash showed the highest efficiency rating in competition with seven other makes of collectors.

Let our engineers help you solve the fume and odor nuisance in your plant. Call our nearest representative or write direct to

CLAUDE B. SCHNEIBLE CO.

P.O. Box 502, Roosevelt Annex
Detroit 22, Michigan



MULTI-WASH SCHNEIBLE

What's your tank problem?

Take our word for it, there's a
Stainless Steel SAN-I-TANK — standard or
special, big or little — that will solve your tank problem. Here
are two standard tanks, for example, that show what we mean:



Type "CJ" is an open top, jacketed, stainless steel tank that can be used for every kind of hot or cold processing. Jacket is warranted to 150 p.s.i. working pressure. Tank can be equipped with side, bottom or top-entering agitators and all types of fittings and connections. Capacities: 60 to 1000 gallons. Write today for Bulletin JS-50.

Type "H" is a horizontal SAN-I-TANK designed to handle large quantities of liquids in minimum overhead space. This is a stainless steel, single-shell. For mixing, blending or storage purposes, it may be equipped with top or end-entering agitator and any type of connections. Available in capacities ranging from 200 to 4500 gallons. Write today for Bulletin SS-50, describing this and other single shell tanks in detail.



STAINLESS STEEL SAN-I-TANKS

METAL GLASS PRODUCTS COMPANY

REDFORD 5, MICHIGAN

New York Chicago Atlanta San Francisco Los Angeles Seattle New Orleans

NAMES IN THE NEWS, cont. . .

research at the new laboratories of Armstrong Cork Co. at Lancaster, Pa. With Armstrong since 1945, most recently as general production manager. Previously in the general engineering laboratory of GE.

Gordon Brown. New president of the Society of the Plastics Industry; one of the founders of the 14-year-old organization. Vice president of Bakelite.



G. Brown



P. O. Powers

Paul O. Powers. Chemical director of Pennsylvania Industrial Chemical Corp., Clairton, Pa. Continues as advisor to the National Research Council on Quartermaster problems. Formerly technical advisor to Battelle Memorial Institute. Some past employers: Atlantic Dyestuff Co., Calco, Newport Industries, University of Pittsburgh (research fellow at Mellon Institute). Graduate of Boston University and Pittsburgh.

John R. Coleman and L. C. Faulkenberry. Assistant superintendents in the film emulsion coating division, Eastman Kodak's Park plant. Mr. Coleman: with Kodak since 1930, most recently in charge of production of color cine negative films. Chemical engineering graduate of Kansas State. Mr. Faulkenberry: with Kodak since 1936 most recently in charge of Kodachrome film production. Studied at the University of South Carolina and Louisiana State.

W. C. Hewitt. To work on special assignment in connection with expansion of the National Synthetic Rubber Program for Phillips Chemical Co., manufacturing division. His successor as plant manager, Plains plant: **A. B. Leonard**, former superintendent, Cactus plant. **T. M. Hipp**, from assistant superintendent to superintendent, Cactus plant.

Jack G. Hine. To carry on research work for AEC at Georgia Tech. Has been assistant professor of chemistry at the institute since

1949. Formerly with Cities Service, MIT, and Harvard.

Charles A. Baer. Project manager, applied physics department, National Research Corp. To work on high vacuum coating development problems. Formerly with Bausch & Lomb, Rochester, N. Y. Graduate in chemistry from Penn State.

Frank L. Cohen. Director of production, Merck; has been assistant to the vice president for production. Joined Merck in 1932 as a research chemist. Studied at the University of Illinois and Northwestern.

Egbert F. Bullene. New chief of the Army's Chemical Corps; brigadier general. Postwar commander of the Army Chemical Center at Edgewood; deputy chief of Chemical Corps since early this year. During World War II: Armored Force chemical officer at Fort Knox; commander of the Chemical Warfare Service Unit Training Center and Replacement Pool at Camp Sibert, Ala.



E. F. Bullene

P. X. English

Paul X. English. Director of industrial engineering, Guy B. Panero, Engineer, of New York and Washington. Wartime chief of the industrial division of the Chemical Corps; brigadier general, retired.

William L. Carpenter. From production superintendent of B. F. Goodrich's tire plant in Miami, Okla., to manager of the plant in Oaks, Pa. With company for 16 years. Chemistry graduate of Northwestern.

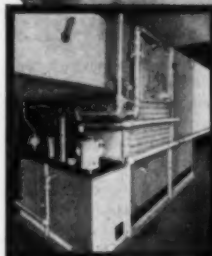
Byron H. Webb. Senior scientist, National Dairy Research Laboratories, Oakdale, N. Y. Has been principal dairy technologist in the U. S. Bureau of Dairy Industry which he joined in 1926. Winner of the Borden Award in 1943.

E. S. Pattison. Manager of the glycerine division, fatty acids section, Assn. of American Soap & Glycerine Producers. Previous employers: (Continued)

humidity

"ENGINEERED ORDER"

IMPROVES MANUFACTURE
LAMINATED GLASS



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HUMIDITY
CONDITIONING

Consistent temperatures between 60° and 70°, and humidities between 10% and 20% R.H. were demanded by one of the nation's largest glass producers for successful manufacture of Safety Glass — where Vinylite plastic is pressed between two sheets of glass.

Kathabar delivered the required precise humidity control. Kathabar equipment supplies up to 40,000 c.f.m. of air, at constant humidities as low as 12 grains of moisture per pound. *That's real dehumidifying!*

Humidity conditioning has been eagerly accepted by the glass industry, as well as many other industries. Don't overlook humidity, one of the basic factors in air conditioning.



"Humidity Engineering"
with the **Kathabar System**

A glass and plastics industry leader has placed 6 repeat orders with Kathabar since 1947 for its production glass laminating and its research laboratory.

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SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

KATHABAR DIVISION



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Wherever you see a Pritchard Cooling Tower, you see water conservation at work. Pritchard Towers are adequately sized, thoroughly engineered, constructed of highest quality materials...and guaranteed to meet your peak as well as normal load requirements. Consult your nearby Pritchard representative for complete information.

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When your piping must meet the strictest code and insurance requirements, you can save time and money by using the services of our experienced specialists. For more than fifty years we have been prefabricating and installing piping to withstand the most difficult corrosion, pressure, and temperature conditions, and we were pioneers in the welding and shop pre-fabrication of stainless. Our patented Westport Joint and "inert-gas-shielded-arc" welding give you piping with maximum strength and absolutely smooth inside walls. For the right answer to your critical process or power piping problem, write us or send your prints for an estimate.



NAMES IN THE NEWS, cont. . .

Mathieson Chemical Corp., Food Industries magazine, and most recently, G. M. Basford Co. (executive vice president). Studied at Rensselaer and MIT.

William E. Ranz and Max S. Peters. Assistant professors of chemical engineering, University of Illinois. Dr. Ranz: on the staff of the Engineering Experiment Station at Illinois for a year; studied at the University of Wisconsin, Ph.D. Mr. Peters will complete his work for a Ph.D. at Penn State in August.

Ronald W. Staley. Engineering supervisor on new mica products for the laminated and insulating products division of GE's chemical department. Since joining GE in 1937: development engineer then group leader, plastics laboratory; section head, pilot operations, new products development laboratory; section head of the laboratory's product evaluation group. Purdue graduate.

Saul Ian Kreps. Chief research chemist, Van Dyk & Co., Belleville, N. J. Job history: chief research chemist for United Merchants Laboratories; research chemist for the Atlantic Refining Co.; most recently, assistant professor of chemistry at the Newark College of Engineering.

Bruno Puetzer. Vice president in charge of research, Schenley Laboratories. Formerly research director for Vick Chemical; joined Schenley in 1949. Vice president in charge of production: James H. Noyes. Plant manager for Schenley since 1944. Formerly with Procter & Gamble's production department.

OBITUARIES

Stanley Gill, 51, consultant in the field of petroleum engineering, died in Huntsville, Tex., May 7. At various times with Gulf Oil Corp. and Mellon Institute, he had been an independent consultant since 1929.

William M. Dehn, 78, professor emeritus and research consultant at the University of Washington, died in Seattle May 21. He taught at the university from 1907 until his retirement in 1947.

David J. Price, 67, principal chemical engineer of the Bureau of Agricultural and Industrial Chemistry until his retirement in 1949, died in Washington, D. C., May 29.



the **MAGIC GENIE** of industry

• Like the magic genie of old, Harshaw Fluorides work capably and efficiently for many industries. They are used advantageously in numerous operations. The top ranking of Harshaw Fluorides is the result of rigidly controlled uniformity and quality.

*A comprehensive group of
Harshaw Fluorides is listed below*

Ammonium Bifluoride	Hydrofluoric Acid Aqueous
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Barium Fluoride	Potassium Bifluoride
Bismuth Fluoride	Potassium Chromium Fluoride
Boron Trifluoride	Potassium Fluoborate
Boron Trifluoride Complexes	Potassium Fluoride
Chromium Fluoride	Potassium Titanium Fluoride
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Fluorine Cells	Sodium Fluoborate
Fluorinating Agents	Zinc Fluoride
Frosting Mixtures	
Hydrofluoric Acid Anhydrous	

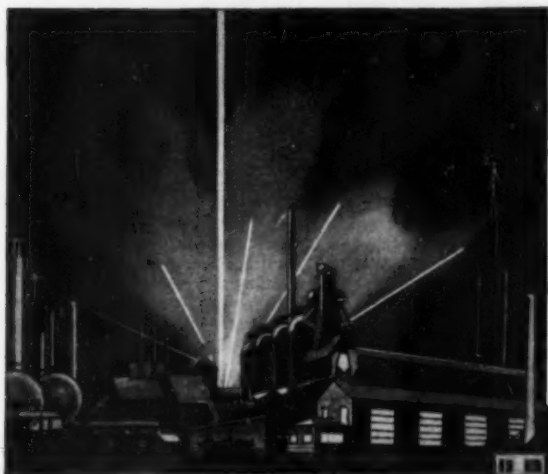
Available upon request . . . M. C. A. Safety Data Sheets SD-25 and H-10 furnishing essential information for safe handling and use of hydrofluoric acid.

THE HARSHAW CHEMICAL CO.

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INDUSTRIAL NOTES

NEW FACILITIES



Lubrizol Corp., Cleveland—A petroleum additives plant recently completed in Deer Park, Tex.

Goodyear Tire & Rubber Co., Akron, Ohio—A special paint development laboratory within its chemical division to concentrate on specialized uses for high styrene-butadiene copolymers. J. J. O'Neill will be in charge.

Commercial Solvents Corp., New York—A market development group under the direction of Frank E. Dolan. Now under way is a market survey on the nitroparaffins and their derivatives based on low projected selling prices reflecting economies resulting from process improvements and contemplated large scale production.

Standard Oil Co. of California, Richmond—A 55,000 bbl. per day vacuum flasher, said to be the world's largest. M. W. Kellogg has just completed installation of the unit.

Westinghouse Electric Corp.—A plant under construction in Union City, Ind., to produce 75,000 electric motors a month. The company also expects to complete this fall two electronic tube plants—one in Horseheads, N. Y., and one at Bath, N. Y.

Frank G. Fanning Co.—A plant in Newark, N. J., for the production of lanolin, wool fat, its derivatives and chemical specialties.

Link-Belt Co., Chicago—A materials handling and processing equipment plant under construction at Colmar, Montgomery County, Pa.

E. I. du Pont de Nemours & Co.—An office building in Newark, Del., to accommodate about 2,000 people. It will be completed in the fall of 1952.

Blaw-Knox Co., Pittsburgh, Pa.—Expanded offices for its chemical plants

division in Tulsa, Okla., to include complete plant engineering and construction services for the petroleum, gas, chemical and process industries of the Southwest.

Battelle Institute, Columbus, Ohio—A million-dollar laboratory building. When completed it will allow a 15 to 20 percent increase in research services.

Arner Co., Buffalo, N. Y.—An analytical laboratory for its Fort Erie, Ont., pharmaceutical manufacturing plant.

General Controls Co.—A 24,000 sq. ft. addition to its present engineering building in Glendale, Calif.

Granite City Steel Co.—A battery of 27 chemical-recovery coke ovens capable of carbonizing 1,830 net tons of coal per day.

Thomas C. Wilson, Inc.—A Philadelphia office to handle sales of industrial tube cleaners, tube expanders and safety bolts.



Upjohn Co., Kalamazoo, Mich.—Plant for penicillin and antibiotics near Kalamazoo. Much of the process equipment extends the full height of the structure which is specially designed with mezzanines to provide ready access to pressure vessels, etc. Most of the company's other pharmaceuticals are produced in a 870-by-1,125 ft. one-story building (also new) on the same site. This construction project is said to be the largest on record in the pharmaceutical field.

Marcus Transformer Co.—An annex which will extend productive space by 50 percent.

Process Industries Engineers, Inc., Pittsburgh, Pa.—An office in Rochester, N. Y., headed by Larry Woll.

Glidden Co., Cleveland—An enlarged Chicago laboratory for its Nubian Industrial Division devoted to prob-

lems concerned with organic finishes for industry from control testing of raw materials to the application of new coatings under production line conditions. The new laboratory is three times its former size.

NEW LINES

Calumet and Hecla Consolidated Copper Co.'s Wolverine Tube Division—Steel tubing. Exclusive rights have been acquired to produce tubes by the patented forming and brazing processes of the Karmazin Products

Speco, Inc., Cleveland—Silicone base waterproofing liquids, automotive and household polishes, through the purchase of all assets of the Silicone Products Co. of America, Cleveland.

Acrovex Corp., New Bedford, Mass.—Precision resistors through the acquisition of Wilkor Products, Inc., Cleveland.

NEW LOCATIONS

Industrial Control Co. has moved to Straight Path and Arlington Ave., Wyandanch, L. I., N. Y.

Process Plants Engineering Co. has moved its offices to 1060 Broad St., Newark, N. J.

Bellevue Industrial Furnace Co. has moved its plant and general offices to 2620 Crane Ave., Detroit.

C. W. Nofsinger Co. (petroleum and chemical engineers) has moved its offices to 906 Grand Ave., Kansas City, Mo.

Meyer Scientific Supply Co., handlers of laboratory apparatus, has moved to 211-215 North Eight St., Brooklyn.

Sarco Co., manufacturers of steam specialties, has moved its Chicago sales offices to 322 West Randolph St.

General Electric's chemical department has transferred its facilities for molding and extruding G-E silicone rubber parts from Pittsfield, Mass., to Decatur, Ill. Capacity has thus been tripled.

Acheson Colloids Corp., Port Huron, Mich., has moved its New England office to 89 Broad St., Boston.

Leeds & Northrup Co., Philadelphia,

manufacturers of electrical measuring instruments, has moved its Houston office to 2480 Times Blvd.

NEW COMPANIES

Dynakon Corp., Cleveland, to engineer and manufacture glass-fiber reinforced plastics parts.

W. E. Major & Co., San Francisco, to act as manufacturers' agents and brokers for the import and export of chemicals and raw materials.

Canadian Westinghouse Supply Co., to distribute products of Canadian Westinghouse Co., Ltd., throughout Canada. Roy L. Brown has been elected executive vice president and general manager.

Olin Products Co., New York, to distribute cellophane to the packaging field for the Ecusta Paper Corp. Both are subsidiaries of Olin Industries, Inc.

NEW NAMES

Sterling Oil & Gas Co., Houston, has changed its name to Tennessee Production Co.

Hercules Powder Co. has established the trade name Kymeme 138 for its wet-strength resin formerly known as Resin 138.

NEW REPRESENTATIVES

Dampney Co., Boston, has appointed three new distributors for its protective coatings for metal: W. C. Christensen, Jackson, Miss.; Marshall, Neil & Pauley, Inc., Houston; Marine Specialty Co., Mobile, Ala.

Otto H. York Co., East Orange, N. J., has appointed Jacobs Engineering Co., Los Angeles, as its sales engineering representative in the Pacific Coast region. York's products include wire mesh entrainment separators, multi-stage liquid-liquid extraction equipment, compressed wire barriers.

Baker Castor Oil Co. products will be sold and warehoused in St. Louis, Mo., by Harry A. Baumstark & Co.

Naftone, Inc., New York, has appointed the following sales agents for its paint driers, tallates, etc.: Charles A. Wagner Co., Philadelphia, for the Pennsylvania territory; T. F. Gehle Co., Detroit, for Michigan; John H. Calo Co., New York for the Metropolitan area and New Jersey.

—End



PROTECTING Modern Ships of the Desert



Paints based on Parlon (Hercules chlorinated rubber) were used on Southern Pacific hopper cars which carry soda ash and other corrosive bulk chemicals over the hot, dry, alkali flats of the Mojave desert in California.

A paint has to be tough to protect metal against the destructive action of the bulk chemicals and the rigors of such desert conditions. The chlorinated rubber finish of paints based on Parlon is designed to give such protection, even after as long as 32 months of exposure.

Get this double protection of outstanding chemical resistance plus durability for your plants, equipment, and rolling stock by specifying paints based on chlorinated rubber.

**Rubber-base
Parlon® Paints**

HERCULES POWDER COMPANY
Cellulose Products Department
952 Market St., Wilmington, Del.

Send further details on Parlon
paints and names of suppliers.

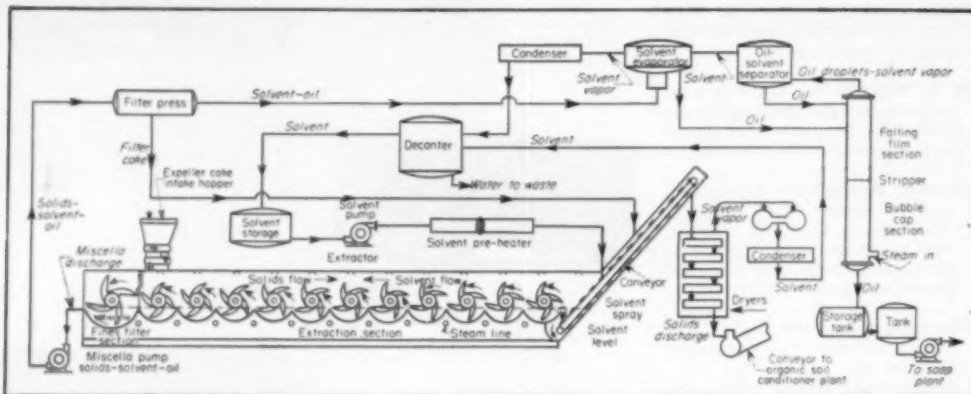
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Company.....

Address.....

City..... State.....

CR51-2



Solvent Extraction of Cocoa Butter

How a byproduct becomes a buy-product. Here are the operating details of a solvent extraction process for making a premium soap ingredient from waste chocolate.

Nothing wasted here. The Hershey Co., well-known for its chocolate, also makes a cocoa butter soap. The cocoa butter comes from expeller cake, a byproduct of chocolate. Specifically, expeller cake is the residue from processing cocoa beans, after the edible portions have been made into chocolate.

The solvent extraction process is one of the most up-to-date in use. It takes about 1.25 lb. (0.2 gal.) of solvent (Esso hexane) for each pound of expeller cake processed. The expeller cake, containing 10 to 15 percent cocoa butter, passes through the extractor in about 30 min. Practically all of the cocoa butter is dissolved out of the cake. Solvent losses, largely from evaporation, are said to be unusually low.

The expeller cake is shipped to the extraction plant in bottom hopper freight cars.

When a car hopper is opened, its contents drop into a chute and onto a conveyor which carries the material to outdoor, concrete storage bins. When needed, the material is conveyed from bins to scales and then is sent to the extraction unit as shown in the diagram.

The extraction unit is essentially a floor-mounted, horizontal steel chamber. Raw material is fed to a hopper

at one end and made to travel through a series of troughs in which revolving paddle wheels keep the solids moving, and also mixed with the solvent flowing in the opposite direction. The solvent dissolves the cocoa butter out of the solids during its journey. Cocoa butter in the form of oil is separated from the solvent. The oil is pumped to the soap plant, the solvent is reused and the solid residue from the extractor is conveyed to the company's adjacent processing plant which bags the material and sells it as an organic soil conditioner.

At the extraction plant, ground expeller cake is dumped into a hopper, thence through two enclosed screw-type feeds connected by an automatic valve. After leaving the first feed, the valve closes to prevent any solvent in the other feed line from backing up into the hopper, thence into the building atmosphere where it might present a fire hazard.

The extractor unit is 50 ft. long, 8 ft. high and 5 ft. wide. Within this unit is a series of 12 semicircular troughs so mounted that there is a difference of 6 in. in height between the first and the last. This assists solvent flow. Operating in each trough is a paddle wheel on a shaft revolving at about 10 rev. per hr. The paddle wheels are driven by gear connections


from a shaft extending the length of the extractor. As the paddle wheels revolve they mix solids and hot solvent and also cause solvent-soaked solids to be moved progressively from trough to trough. The solids and solvent are fed into the extractor from opposite directions, as shown. The chart also shows that miscella—solvent-oil mixture containing some solids—leaves the extractor at one end while practically all solids are discharged upon a conveyor at the opposite end of the unit.

In passing through the extractor, which requires about 30 min., practically all cocoa butter is dissolved out of the expeller cake which originally contained from 10 to 15 percent cocoa butter. After miscella and solids leave the extractor, each is processed separately.

The solids are picked up by the last paddle wheel and dropped upon a conveyor which slants so it can discharge into the extractor, is first passed through a filter press to separate solids from a solvent-oil mixture. The solids are recycled to recover any remaining oil. The solvent-oil mixture is sent through a high velocity Callandria steam evaporator. The mixture enters the bottom of the evaporator and is pumped up through the tubes while the steam on the outside of the tubes causes about 85 percent of the solvent content to be evaporated, leaving the 15 percent remaining to be recovered from the stripper. The evaporated solvent is condensed

(Continued)

**NO OTHER METHOD
HAS all THE ADVANTAGES OF
SODIUM REDUCTION**



REACTOR

SOYBEAN OIL

FISH OILS

LINSEED OIL

ROSIN ESTERS

OLIVE OIL

NITRILES

TUNG OIL

PALM OIL

CLUPANODONYL ALCOHOL

AMINES

LAURYL ALCOHOL

LINOLEYL ALCOHOL

CETYL ALCOHOL

ABIETYL ALCOHOL

OLEYL ALCOHOL

LINOLENYL ALCOHOL

for producing long-chain alcohols from natural fats and oils

Check these Advantages

- ✓ unsaturation can be retained
- ✓ applicable to wide range of raw materials
- ✓ no high pressure required — uses standard equipment
- ✓ no catalyst required
- ✓ low maintenance cost
- ✓ gives high quality products without undesirable by-products.



The Sodium Reduction method is an established commercial process for producing long-chain alcohols from natural fats and oils. It is not limited to any particular natural product.

Sodium Reduction offers a distinct advantage in the manufacture of unsaturated alcohols such as those derived from fish, soya, linseed and other natural fats and oils. Alcohols having a degree of unsaturation equivalent to the starting materials have been produced by this method.

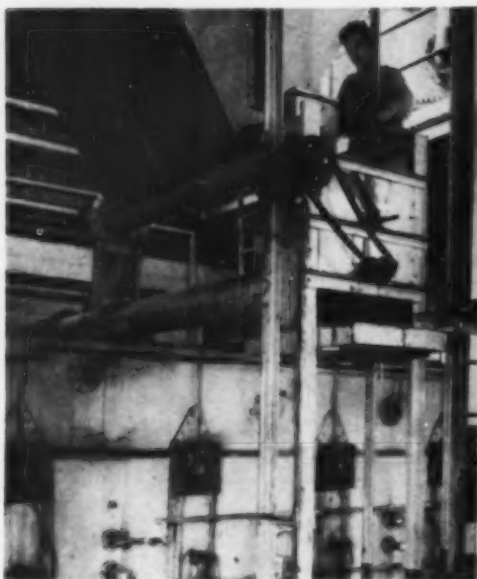
Among the suggested uses for these unsaturated alcohols are the preparation of vinyl and allyl ethers, methacrylate esters and phosphate esters. These derivatives have properties which indicate possible application in the field of drying oils, plasticizers, paint resins, synthetic waxes, elastomers, polymers and emulsifying agents.

Metallic Sodium may be used to advantage in the reduction of nitriles, esters and ketones.

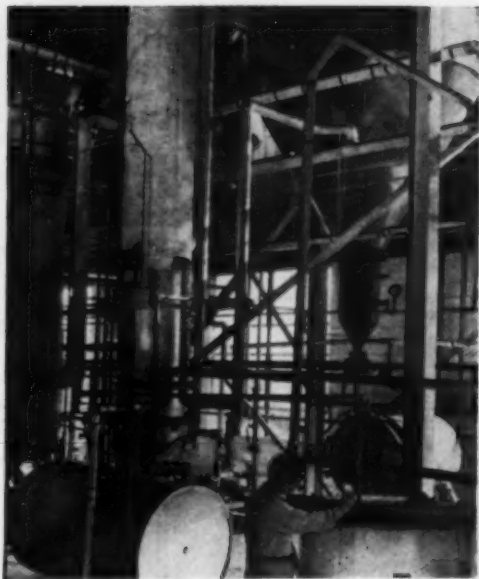
Perhaps your process or product can benefit from this method of reduction. National Distillers Chemical Corporation will welcome your inquiry.

National Distillers
CHEMICAL CORPORATION

Plant and Sales Offices: Ashtabula, Ohio



FEED end of the solvent extraction unit in which crushed expeller cake is made to travel countercurrent to the flow of solvent.



STRIPPER column, filter and tanks in the plant. Lower half of stripper produces finished cocoa butter in the form of hot oil.

QED, cont. . .

and then decanted along with water vapor. The flow chart shows solvent leaving the decanter for storage and water going to waste. The water is condensed steam which backs up from the stripping column and to some extent from other units.

Oil with 15 percent solvent is pumped into the upper half, or falling-film section of the stripper. The oil-solvent mixture enters the stripper and spills over the slots so that it is caused to flow down the inside surface of the tubes. The heat causes the solvent to vaporize, carrying with it some oil droplets. Droplets and solvent are separated, the solvent going to the condenser and the oil being returned to the stripper. Most of the oil in the stripper, however, results because of solvent evaporation. This oil containing a small amount of solvent, falls through the tubes to the steam heated bubble-cap section of the stripper. In this section the remaining solvent is vaporized and sent upward and out of the stripper, while the hot, solvent-free oil passes out of the stripper into a primary tank, thence to a second tank from which samples are taken. Lastly the oil is pumped to the soap factory.

From Esso Oilways



COOLING TOWERS such as the induced draft towers shown above, may help lessen a grave problem we may be overlooking. The problem . . .

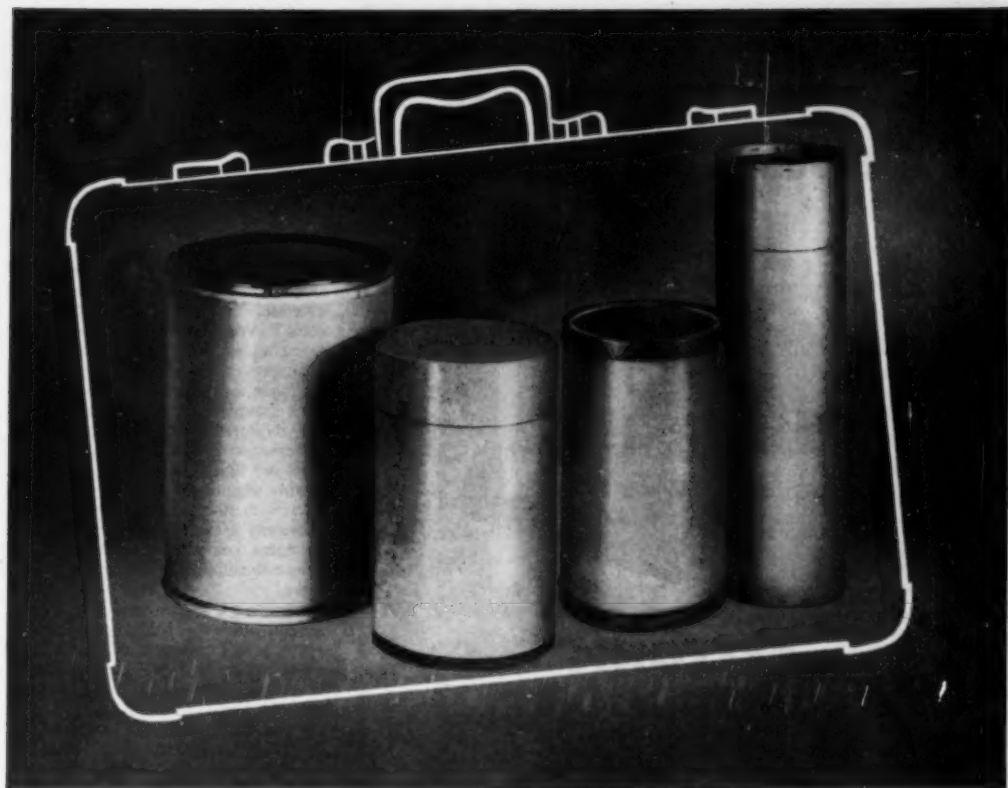
Do We Waste Too Much Water?

Chemical and drug industry requirements have increased 45 percent in the last ten years. Yet all available data show that we are using more than nature is replenishing.

Raymond C. Kelly

To succeed in our efforts toward international leadership in world peace by virtue of strength, we have a major task yet to complete. Although many elements of our industrial, polit-

ical and social economy have been well studied and substantially planned, the primary natural resource of water is yet to be adequately measured for
(Continued)



HEAVY PRODUCTS TRAVEL LIGHT IN THESE CONTINENTAL DRUMS

You can't beat Continental fibre drums for shipping economy. Their light tare weight means worthwhile savings at today's high freight costs — even greater savings on export shipments to countries where import duties are levied on the gross weight.

Continental fibre drums are built to stand up under rough handling. They are rugged and durable, give extra protection to both expensive and dangerous

articles for shipment across the country or across the world. Closures are tight and strong — but easy to open and easy to close.

When it comes to appearance — Continental fibre drums are trim and neat. They come in a complete line of sizes from 3/4- to 75-gallon. Attractively printed or spray painted, each Continental drum is a star traveling salesman for your company.

CONTINENTAL CAN COMPANY

FIBRE DRUM DIVISION

VAN WERT, OHIO

NEW YORK
CHICAGO

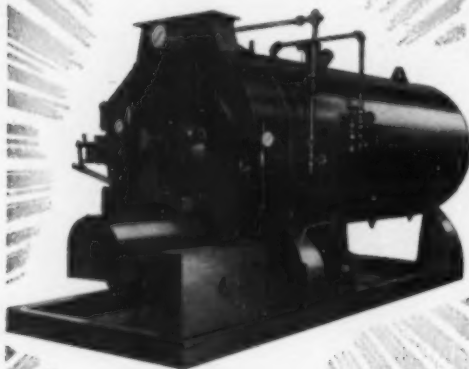
• PHILADELPHIA
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YEARS AHEAD in Steam Generation



CYCLONIC COMBUSTION!

The slogan "Years Ahead in Steam Generation" is *Not* just an advertising phrase but is a statement of fact.

The truly amazing method of Cyclonic combustion has been proven successful by U. S. Industry and again by the Armed Services.

Full power operation from a cold start in 15 to 20 minutes. Savings up to 50% on maintenance. Great fuel operational savings.

Details of these and many other facts regarding Cyclotherm generators are available by writing Dept. E.

Boilers are designed for oil or gas operations from 18 thru 500 h.p., 15 to 200 lbs. operating pressure.



 **CYCLOTHERM**
STEAM GENERATORS
OSWEGO, NEW YORK

QED, cont. . .

availability, thoroughly studied for distribution and comprehensively protected by intelligent utilization. Our ultimate industrial strength may well be dependent upon the availability of water.

It is not appropriate that engineers quietly accept unqualified generalities such as "large chunks of our country are running out of water" or "in several areas water levels have dropped 55 ft. in six years" or "the Louisville watertable is down 40 ft. in ten years." We must develop accurate data coupled with intelligent analysis and specific recommendation. Federal agencies, state commissions and local groups have become aware of the importance of industrial plant conservation measures. The active attack on the problem has already begun. Aggressive pursuit must follow. It is not good management to wastefully use water when invocation of water conservation methods can reduce the slope of the operating cost curve.

Omitting statistics from new plants built during the period of 1939 to 1949 it is apparent that the use of water by established basic industries in the midwestern area has increased over 40 percent in the past decade. Of the total water consumption in the average large industrial plant 53 percent is used for cooling, 31 percent used in process, 8 percent in boiler feed water, 5 percent for sanitary purposes and approximately 3 percent for miscellaneous purposes.

In the chemical and drug industry, the estimated increase in total water required for the 10-yr. period ending in 1949 was 45 percent. Yet available data indicate a current withdrawal exceeding natural replenishment in most industrial areas.

Our present average gross consumption of water is approaching 800 gal. per day per capita. If only the power industry water requirement be considered or if only, by itself, the other industrial water load be considered, we might not be so actively concerned. However, when confronted with a constantly increasing population, with its domestic demand, we face, at the same time, the problem of developing an additional 100 gal. per capita supply within the area in the next ten years. Although equating this total demand against our average 30 in. of rainfall per year over the continental land mass shows that we have developed facilities to utilize only 2 percent of the total precipitation, we find the cost of water conserving equipment to be generally less than the cost of de-

veloping new sources of raw water. An extreme case at point is the new Key West, Fla., 5,000-kw. steam-turbine unit for which fresh water supply is pumped 150 mi. through a 14 in. diameter pipe. A cooling tower is here definitely indicated.

On both coasts and across the northern third of the mid-continent area a gradual decrease in measured rainfall is recorded over the last 50 yr. Wisconsin shows a decrease of 3.48 in. per yr., New Jersey a decrease of 3.81 in. per yr. and Oregon a decrease of 3.81 in. per yr. This is not yet established as a positive trend but is deserving of critical analysis before contemplated reservoir replenishment is accepted for power production within any one locality.

With eight of our 48 states presently controlling the use of surface and underground waters within the state by legislative regulation and with 131 major cities preparing to answer the problem with local regulation governing the use and waste of water, thorough investigation of water conservation procedures will soon be standard engineering procedure in the consideration of power plant operation, expansion, annual operating costs and plans for ultimate plant requirement. It is to be hoped that the foresightedness of the power industry in its judicious use of efficient water conservation devices may so minimize the requirement of federal action that major emphasis may be placed upon the preservation of our greatest natural resource rather than upon the regulation of its use in the production of energy.

Raymond C. Kelly, J. F. Pritchard and Co., before the National Assn. of Power Engineers, Chicago, April 4, 1951.

GRADUATE ENGINEERS

. . . 37% for Industry

FROM 18,630 NEW ENGINEERS IN JUNE

- ..11% to be commissioned in ROTC
- ..16% Reserves or National Guard
- ..36% Draft Eligible

..63% Total available to armed services.

These are the results of a survey conducted by the Engineering Manpower Commission of the Engineers Joint Council.

The commission wanted to find out what proportion of this June's 38,000 engineering graduates would be taken by the armed services, what proportion would be left for industry.

(Continued)

METAL POWDERS

for the

CHEMICAL INDUSTRY

The growing importance of metal powders to the chemical and process industries is indicated by their widespread usage as reducing agents and catalysts, and as raw materials in the preparation of compounds.

PLASTIC METALS, with 17 years of experience in development and production, is one of the leading manufacturers of metal powders in this country. Its extensive electrolytic, reduction, pulverizing, annealing and screening facilities are being expanded still further to better serve today's increasing demand.

PLASTIC METALS produces metal powders in a wide variety of grades featuring:

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2. Particle size distribution to suit requirements—ranging from 20 mesh to finer than 20 microns
3. Irregularly shaped or spherical particles
4. Range of apparent densities
5. Lot to lot uniformity of quality

Iron, steel, nickel, manganese, silicon powders, combinations of these powders or these powders in combination with other materials can be supplied in accordance with your specifications. Our Research Staff is at your disposal for a detailed discussion of your metal powder problems, or possibilities.

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PLASTIC METALS

DIVISION OF THE NATIONAL RADIATOR COMPANY
JOHNSTOWN, PENNSYLVANIA

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**HARD
MATERIALS?**
(Carbide)



**SEMI-
ABRASIVE?**
(Gypsum)



FIBROUS?
(Asbestos)



FRIABLE?
(Alum)



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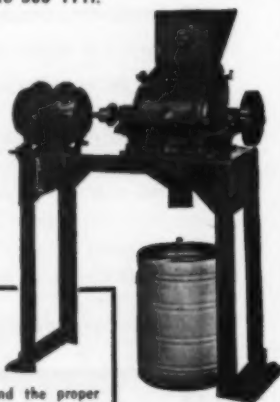


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AMERICAN LABORATORY CRUSHER

The perfect answer for laboratory or pilot plant installations. Reduction accurately controlled to any degree of fineness for a wide range of organic or inorganic materials such as chemicals, pigments, minerals, foodstuffs, and clays. Available in two easy-to-clean sizes: 9 x 9 and 15 x 9 Mills, with capacities up to 2000 lbs per hour.



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ST. LOUIS 10, MO.

QED, cont. . .

A questionnaire was mailed to the deans of the 135 engineering colleges accredited by the Engineers Council for Professional Development. The 86 colleges answering the questions expect to graduate 18,630 engineers in the next month—about 50 per cent of the expected graduates.

From the Engineers Joint Council.

HIGH PRESSURES

. . . Higher and Higher

C. O. Strother

Commercial high pressure chemical processes are now operated up to 50,000 psi., as contrasted with the prewar limit of 15,000 psi. However, high pressure research has been conducted at pressures up to 150,000 psi., and a "hot ice" which exists at temperatures higher than the boiling point of water, was produced at a pressure of 600,000 psi. For comparison, pressures developed in the firing of guns and cannons range from 50,000 to 100,000 psi., and the pressure in the deepest part of the ocean—about 6 miles down—is some 15,000 lb.

High pressures are important in chemical processes because, by bringing the molecules of substances closer together, they bring into play forces of attraction between the molecules that do not operate at the greater distances normally prevailing. Polyethylene can be produced from ethylene gas only by the use of high pressures for this reason. High pressures also activate molecules by distorting them.

There is no question that the crowding together of the molecules causes associations that do not exist at lower pressures. High pressure research—a rather neglected field—is best carried out in a flow system in which the chemicals are passed through the reaction zone. This creates many peculiar problems.

If water is present in the system, ethylene gas will form a solid compound with the water at about 3,000 lb. pressure. This compound will plug up the lines. At 1,000 psi., nitrogen gas will dissolve the lubricating oil, a fact which is sometimes troublesome. Most materials are either solids or very thick liquids at these tremendous pressures.

We have developed a pump that will behave rather well somewhat above 100,000 psi., but because of the

factors just mentioned, there are very few materials outside of the permanent gases that remain sufficiently fluid to be pumped at such pressures.

Because of the influence of high pressure on chemical reactions and the profound effects it has on the form in which matter exists, high pressure work is important in scientific research aimed at understanding the structure of matter and the nature of chemical processes.

For a high pressure process to be attractive for large-scale operations, it must be an exceedingly rapid reaction to allow a high throughput. This is because very large-sized, thick-walled equipment is not feasible, and even moderate-sized high pressure equipment is expensive. It is therefore necessary to process a large amount of material through the moderate-sized equipment to justify the investment.

C. O. Strother, Linde Air Products Co., before the American Chemical Soc., Buffalo, May 22, 1951.

CERMETS

... Alumina, Chromium

A. R. Blackburn and T. S. Shevlin

Data from several years work on cermets have now been declassified. One of the first postwar projects to study these materials accomplished a considerable amount of work developing techniques for fabrication.

One early major problem was preventing the metal from sweating out of the bodies. This was overcome by the use of very fine materials. All materials were -325 mesh when they were received, but were reduced to just a few microns in size. For example, alumina as T-61 Alcoa Corundum was reduced to get 50 percent of 10 micron and 10 percent of 1 micron sizes and a surface factor of 6,180 sq. cm./g. Ball milling of 150 to 500 hr. in steel mills with tungsten carbide balls in methyl alcohol was

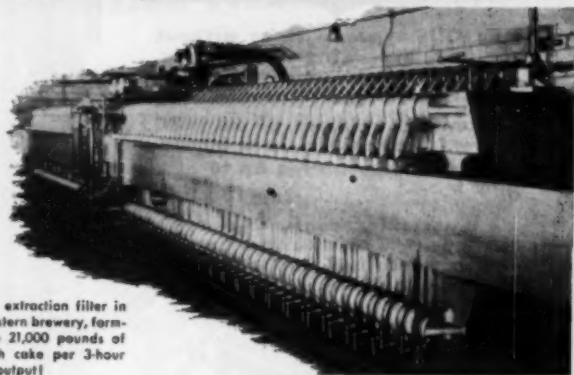
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TECHNICAL MEN COME OF AGE

"Our civilization and our national institutions have become so complicated and highly technical in character that they have grown beyond the particular type of genius possessed by our political leaders. The problems involved must be solved by scientific and technical men."

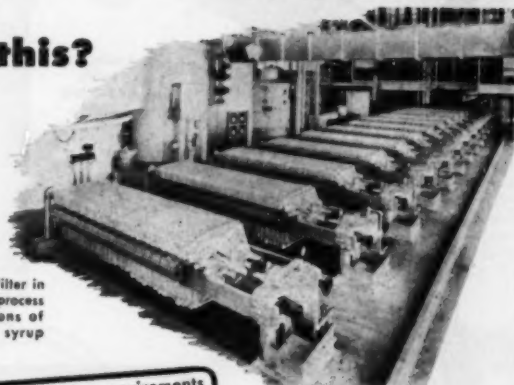
JOHN J. O'NEILL, Science Editor
New York Herald Tribune

Need Filter Capacity as big as this?



Double mesh extraction filter in prominent Eastern brewery, forming 15,000 to 21,000 pounds of sparged mash cake per 3-hour cycle. That's output!

or this?



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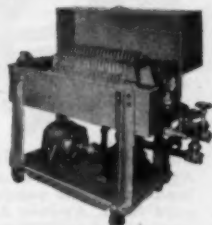
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up to 100,000 psi.

QED, cont. . .

used to reduce particle sizes at first. Later, other types of milling equipment such as rubber lined steel, aluminum mills, and alumina balls were tried, to reduce the amounts of impurities. Micronizing was finally resorted to as a quick and easy method of getting fine particles.

Test pieces were formed from granulated material either by pressing in steel dies or by hydrostatic pressing. In general, it was preferred not to use any organic binders. However, if they were used they had to be removed in a pre-forming operation before the final sintering. The final sintering is done in a purified atmosphere of inert or reducing gases, but with a controlled amount of moisture added to partially oxidize the metal particles. These metal particles then become chromium oxide which will form a solid solution with alumina.

Properties of the 30 chromium—70 alumina cermet which are now declassified, are as follows:

Shrinkage.....	13-14.5%
Porosity.....	0.5%
Theoretic density.....	4.68-4.72 g./cc.
Specific gravity achieved.....	4.6-4.65
Thermal expansion.....	9.45×10^{-6} (925-1,315 deg. C.)
Thermal conductivity.....	$66.5 \pm 20\%$ (800 deg. C.) Btu./hr./sq. ft./in./deg. F.
Thermal shock.....	10 cycles from room temperature to 2,400 deg. C. and back to room temp. accompanied by a 15-20% gain in strength.
Oxidation resistance.....	Good to 2,750 deg. F.
Vickers hardness.....	1,100-1,200
Modulus of elasticity.....	5.25×10^6
Impact strength.....	18-19 in. lb./sq. in. of area
Compressive strength.....	320,000 psi.
Bending strength (short time test).....	Rm. temp. 55,000 psi. 1,600 deg. F. 43,125 psi. 2,000 deg. F. 32,800 psi. 2,400 deg. F. 24,000 psi.
Tensile strength (short time test).....	Rm. temp. 35,000 psi.
Strain rupture tensile (1,000 hr.).....	At Rm. temp.: 24,000 psi. in bending, 16,000 psi. in tension; At 2,200 deg.: 12,000 psi. in bending, 11,800 psi. in tension.
Density advantage over metals.....	Approx. 2:1

A. R. Blackburn and T. S. Shevlin, before the American Ceramic Soc., Chicago, April 26, 1951.

CERMETS

. . . Boron Carbide, Iron

H. J. Hamjian and W. G. Lidman

Boron carbide, a refractory of low density and high refractoriness, was tested with cobalt, iron, nickel and chromium metals.

After preliminary tests, iron and boron carbide were selected as most promising for further tests.

The Fe-B₄C body selected for further study contained 36 percent by weight (15 percent by volume) of

iron and was formed by hydrostatic pressing at 10,000 psi., then sintering at 3,700 deg. F. for 1 hr.

Modulus of rupture tests on this mixture show that the pure, hot pressed boron carbide is somewhat stronger than the cermet; however the pure boron carbide does not resist thermal shock satisfactorily. The cermet has better oxidation resistance at 1,600 deg. F. than does the pure carbide, but the carbide is better at 2,000 deg. F.

Modulus of rupture values for pure boron carbide varied from 50,000 psi. to around 35,000 psi. over the range of 0 to 2,500 deg. F. Iron bonded carbide decreases in modulus of rupture strength from 40,000 to around 30,000 over the 0 to 2,500 deg. F. temperature range.

H. J. Hamjian and W. G. Lidman, before the American Ceramic Soc., Chicago, April 26, 1951.

MOBILIZATION

... From Haile Selassie

Eric A. Walker

Sometimes in the midst of the manpower problem, a man thinks a bit wistfully of the manpower directive attributed to the Emperor Haile Selassie who is supposed to have issued the following call to arms when the Italian Armies invaded Ethiopia:

"The country is now mobilized. All men and boys able to carry a spear will report for active duty. Married men will bring their wives to do the cooking; men who are not married will bring any women they can find. The very young, the very old, and women with very young children need not report for active duty. Anybody else found at home after the issuance of this order will be hanged."

... To General Hershey

Now contrast that with the Hershey plan. Under this plan, college students will have two means for obtaining deferment. All undergraduates who are liable for induction will be given an aptitude test devised by the Educational Testing Services, Princeton, N. J. Those who make a grade of 70 will be permitted automatically to complete their courses, providing they remain in good standing with their own institutions. Graduate students will be permitted to complete their courses if the institutes which they are attending certify that they are meeting degree requirements and are expected to obtain their degrees.

Those who fail to make the minimum grade of 70 will be permitted

(Continued)

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Literature describing Weston all-metal, as well as electrical and glass thermometers, sent on request. WESTON Electrical Instrument Corporation, 583 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and TAGliabue instruments.

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QED, cont. . .

to begin the following school year if their academic standing places them in the top half of the freshman class, the top two-thirds of the sophomore class, or the top three-fourths of the junior class. Seniors may begin graduate work if they are in the top half of the senior class or if they make 75 or above on the test.

Eric A. Walker, Department of Defense Research and Development Board, before the 3rd Annual Northern California Research Conference, San Francisco, April 8, 1951.

NATURAL WATERS

. . . A Definition

Raymond W. Hess

Natural waters can be grouped broadly into two classes—surface and sub-surface waters. Each of these can be divided further into several classes having different degrees of purity. Here are just a few examples: There is a marked difference between the salt content of the sea and streams. Some streams are turbid and others are sparkling clear. Some waters are unpalatable while others are tasteless. Infant illness and mortality has been traced to the presence of naturally occurring nitrates in ground waters.

Natural waters are defined as those containing a large variety of inorganic and organic substances in solution in relatively small quantities, of inorganic and organic substances in suspension. It also occasionally contains in large quantities, a myriad of macroscopic and microscopic plant and animal life and the byproducts of their living processes and death. All of these continually react with each other, physically, chemically and biochemically, to maintain a balance of properties within the relatively narrow limits of nature. In other words they are very complex heterogeneous systems having chemical, physical and biological properties which vary appreciably in relative intensities, especially in different localities, depending on differences in topography, geology,

\$5 BILLION IN A VACUUM

"The United States bought \$5 billion worth of nothing in 1950 because of price increases."

MICHAEL V. DeSALLE, Director
Office of Price Stabilization

temperature, precipitation and other natural conditions. These waters are usually, but not always, suitable for man's specialized or even his common uses.

The many complexities of these systems may be resolved into two characteristics of most direct interest to the pollution problem. These two characteristics are oxidation potential and alkalinity.

Oxidation potential is most directly related to the presence of dissolved oxygen and aerobic organisms. Oxygen dissolved in water has a solubility in the range of 7-14 ppm., depending on the temperature, and its concentration in surface waters is at about this level. It has a continuing source in the atmosphere and plant life in the water. With the help of aerobic organisms this element oxidizes organic substances, giving carbon dioxide as one of the products, and some inorganic substances to more stable products. For example, hydrogen sulphide which is sometimes present in natural waters to man's detriment, is eventually oxidized to sulphur and sulphuric acid.

Sub-surface water usually contains little or no dissolved oxygen. That which is present when surface waters seep into the ground is consumed in the oxidation of organic and inorganic substances in the earth and has no source of replacement.

Alkalinity of natural waters is usually due mostly to the presence of calcium bicarbonate giving temporary hardness. Its concentration, in Lake Erie and the Niagara River, calculated as calcium carbonate is about 100 ppm. It is formed by the action of carbon dioxide on limestone. Limestone is always in contact with surface and sub-surface waters. The continuing source of most of the carbon dioxide is the atmosphere and the biochemical oxidation of organic matter in water referred to above. This substance neutralizes the sulphuric formed by the oxidation process, referred to above, forming calcium sulphate which imparts permanent hardness to water.

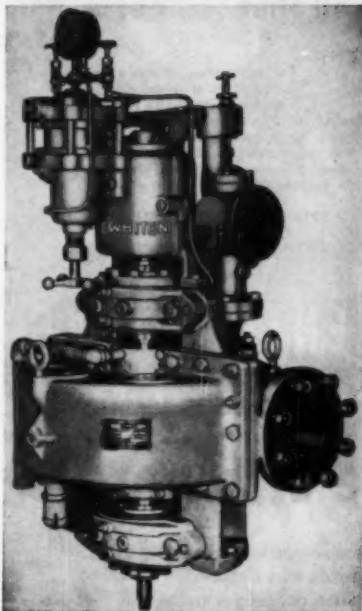
Thus, it is observed that nature is continually discharging organic and inorganic substances, similar in general to man's wastes, into natural waters and then developing forces to counteract them. When the amount of organic substances increases, it is destroyed by an increasing number of oxidizing organisms. This phenomenon is generally recognized as nature's capacity for self-purification.

However, the balance of nature does not always remain the same. For example, sea water of natural purity
(Continued)

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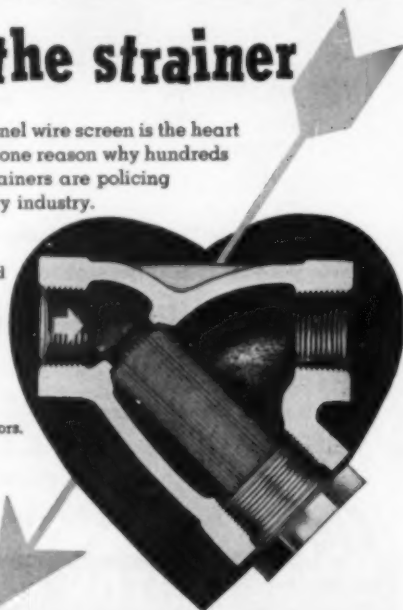
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YARWAY STRAINERS

QED, cont. . .

is unsuitable for drinking and some industrial uses because of high salt content. Obviously nature doesn't succeed in holding down the concentration of some substances which she adds to her waters.

Raymond W. Hess, Water Pollution Advisory Committee, before the Western Section, AICHE, March 8, 1961.

AMMONIUM NITRATE

... Promising Fertilizer

R. C. Tallman

Ammonium nitrate is rapidly gaining favor as a fertilizer and may become the preferred material for direct application to the soil. Although its plant-food properties have been known for a long time, before 1943 ammonium nitrate had been used only in solutions for the preparation of mixed fertilizers. Some of the product was released from government plants for fertilizer use in 1943 and since then the compound has enjoyed a meteoric rise to prominence as a fertilizer material.

Advantages are its comparatively high nitrogen content, its wide adaptability to soil and climatic conditions, its comparative resistance to leaching, and probably of greatest importance, its low cost per unit of nitrogen. Some experts feel that ammonium nitrate will eventually be the nearly universal fertilizer of choice for direct application.

Early attempts to use ammonium nitrate in solid form were hampered by its tendency to cake in the bag and set into hard, tombstone-like blocks which could be broken up for application only with the greatest difficulty.

This problem was finally remedied by coating or "conditioning" the ammonium nitrate in the pelleted form with various materials such as diatomaceous earth. Under these conditions, bagged ammonium nitrate can be shipped, stored and applied as readily as other fertilizer material.

R. C. Tallman, Lion Oil Co., before the American Chemical Soc., Cleveland, April 19, 1961.

WASTE WATER

... Chemical Treatment

H. Schindler

Two types of waste water are produced: (1) water containing sulphur

July 1951—CHEMICAL ENGINEERING

dioxide, and (2) acidic or alkaline process waste water containing water-soluble petroleum sulphonates which originate at white-oil and petroleum sulphonate plants. After extensive laboratory and pilot-plant work, a procedure was developed which combines the disposal of both wastes in a simple and economical way. The procedure is based on the finding that the process waste water can be decolorized by converting the water-soluble sulphonates into the insoluble calcium salts, and that this reaction can only be successfully completed if the free sulphonic acids, rather than the corresponding salts, are reacted with lime. On this basis, the following method was found to be most advantageous, because it combines the chemical requirements of the process-water disposal with the purification of the sludge-conversion plant waste water:

1. Adjustment of process waste water to a pH of 5 by mixing with acidic water from sludge-conversion plant.

2. Precipitation of sulphonic acids and mineral acid with hydrated lime at a pH of 7.0 and 8.4.

3. Continuous settling of precipitate and discharge of treated water.

The small-scale results with this procedure were so encouraging that it was decided to use it full-scale, and a complete plant was designed. The heavy construction work was carried out by a contractor and the equipment was installed by the refinery staff.

H. Schindler, L. Sonneborn Sons, Inc., before the American Petroleum Inst., Tulsa, May 1, 1951.

CATALYTIC CRACKING

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B. J. Duffy and H. M. Hart

Minute amounts of metallic "poisons" in crude oil could cause the loss of enough potential high-octane gasoline at the refinery to supply the average motorist a lifetime.

Process engineers of the Standard Oil Co. (Indiana) have learned that as heavier portions of crude oil are subjected to catalytic cracking to increase the yield of gasoline, minute quantities of metals contained in the crude oil tend to "poison the cracking catalyst." Although the total weight of metals in a million gallons of oil may be as little as 10 lb., the catalyst poisoning can result in a loss of as much as 40,000 gal. of potential gasoline.

Methods have been developed which have enabled the Standard Oil
(Continued)

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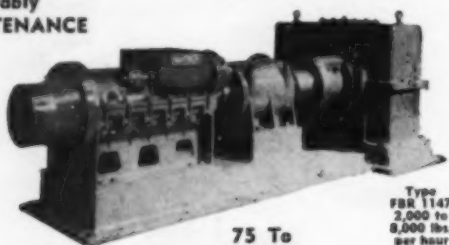
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QED, cont. . .

Co. to operate its catalytic cracking unit at Sugar Creek, Mo., for maximum gasoline yield. Reducing the amount of various metals in the oil to be cracked is one method which has been investigated. In addition, a continual partial replacement of "poisoned catalyst" with fresh, non-poisoned material can be of benefit. The prediction of the effectiveness of these two corrective measures combined, enables the refiner to maintain his catalytic cracking unit at optimum production of catalytic gasoline.

B. J. Duffy and H. M. Hart, Standard Oil Co. of Indiana, before the AIChE, Kansas City, May 16, 1951.

SAFETY

... From Explosive Gases

Otto C. Haier

A large oil company has gone a long way in overcoming one of the most hazardous of refinery conditions—that of combustible gas concentrations in confined spaces. They did it by installing an automatic combustible-gas alarm system. This system, a development of Mine Safety Appliance Co., was adopted following a costly explosion in the Cleveland refinery's gas compressor house five years ago. Since the detecting and alarm system was installed, it has operated several times to warn of gas concentrations approaching explosive limits.

Four explosion-proof combustible gas alarms in the gas compressor house now continuously sample the atmosphere at four points between pairs of compressors. Air samples, drawn into the instruments at a velocity of about 10 ft. per sec. from intakes slightly below floor level, are passed over a sensitized platinum filament. Resistance of the platinum wire is increased in proportion with the temperature rise resulting from this combustion and the electrical circuit between the two filaments becomes unbalanced in direct ratio.

An indicating meter on the face of the instrument shows the concentration of combustible gases at all times. When the concentration reaches a predetermined limit—40 percent of the lower explosive limit—warning signals are activated as the meter needle is drawn by magnetic attraction to a contact point closing the warning circuit.

—End

Otto C. Haier, Standard Oil Co. of Ohio.



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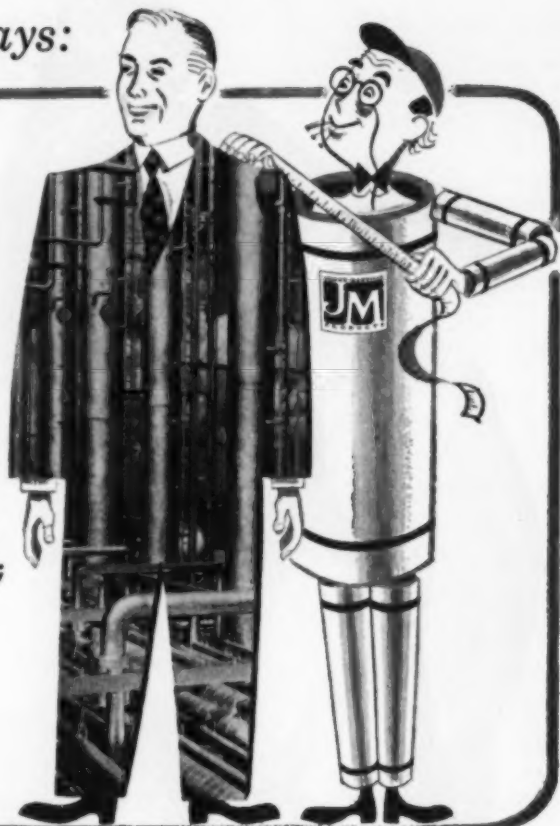
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INSULATIONS

Does Twice as Much Mean Twice as Useful?

Two books, similar in purpose, are now available. One is \$4.50 with 340 pages; the other is \$8.50 with 913 pages. Which is better for your purposes?

It's probably coincidence. Two different publishers have just brought out similar new handbooks.* Both books will give you quick answers to many questions about materials.

Let's look at the older one first, then the younger, then both together. Let's find out how and how much they can help you.

BRADY

The Materials Handbook is an old friend. On hand since pre-depression days, it's a familiar standby. It's the first place I look when someone asks questions such as this one we got recently, "Is tartaric acid used in rayon manufacture?" Brady didn't know either, so I had to look further. But if the question had been, "Is tartaric acid used as a mordant in dyeing?" Brady would have given a quick, "Yes."

If you don't know the book, here are some things I said about the fourth, fifth and sixth editions:

Fourth Edition—"Lists thousands of materials with such general information as chief characteristics, comparative data, sources, substitutes and uses." (*Chem. & Met.*, Dec. 1940, p. 882.)

Fifth Edition—"Quickest way to locate information is to consult the index. Reason: materials are not always where they might be expected to be found in an alphabetical listing." (*Chem. & Met.*, Dec. 1944, p. 220.)

Sixth Edition—"In addition to various tables of units of measure, physical and other data, Part II has brief articles on geophysics, nuclear physics, geology, production of plant and animal materials, waves and colors, flavor, biotics, textile and drug terminology, government agencies, and visual aids." (*Chem. & Met.*, April 1948, p. 288.)

Seventh Edition—"The quotes above still apply. But let's go further. Let's make the letter 'A' a sample and see

what's new and different—what's right and wrong. Here are a few comparisons of editions six and seven.

Acetic acid now includes some information on both peracetic acid and trifluoroacetic acid.

Acetone, Brady says, is produced by grain fermentation. He thus accounts for only about 6 percent of our total production. Most acetone is derived from isopropyl alcohol.

Acetylene snow, not in edition six, is described briefly.

Acrylonitrile is a new heading which very properly has been added.

Activated charcoal has been corrected from adsorbent to adsorbent.

Ajowan oil has had the facts of its entry rearranged.

Aluminum alloys include those with beryllium. (Elsewhere in the book it is properly beryllium.) Simalec somehow has become Similac which is an entirely different kind of formula.

Ambergris used to be included under Amber with the notation "no relation to Amber." It now rates an entry by itself. Perhaps this reflects increasing yields. In edition six "Lumps weigh up to 150 lb." and in edition seven "Lumps weigh up to 600 lb."

Ammonium thiocyanate has disappeared. Its information turns up under Urea.

Ammonium acetate, too, is gone but the information remains. Find it under Amyl Alcohol.

Likewise Angico goes to Curupay and Aqua Regia goes to Hydrochloric Acid.

Antioxidant is another newcomer. This is a subject that is commercially important in oils and fats, rubber and other organic products. The entry introduces a term new to the book: synergists.

You may extrapolate the findings of this sampling. If you do, you'll have a good picture of the changes evident throughout the whole book. One thing should be added, however. Many of the items have been improved by pruning old outdated material or by grafting on new information. And frequently both operations were performed on one entry. Of course

there remains a significant quota of entries where no change at all was found necessary.

Typographically the book is a big improvement over edition six.

KNIGHT

The Materials Buying Manual is aimed at the same audience: purchasing agents, executives, engineers, superintendents, foremen. It has 84 entries, 79 of which are of interest in the chemical process industries. (The five I omit: die castings, hardwood lumber, pig iron, powdered metal parts, sand & gravel.)

The 79 fall into two classes: materials and chemicals. Again using the letter "A" as sample, the materials are abrasive, aluminum, antimony, asbestos, asphalt. The chemicals: aluminum sulphate, ammonia, aniline. This ratio—5 to 3—is high. There are about as many chemicals (like chlorine, chloroform, citric acid) as there are materials (felt, ferro alloys, fiberboard). Average entry is just under two pages in length (1.98), but the chemicals are the shorter. For example, naphthalene is less than 1 page, nickel is $\frac{5}{8}$, nitric acid is long at $\frac{2}{3}$.

The entries are well written and easy reading. For the chemicals they usually give uses, derivation, appearance, constants, grades and approximate price. All this is just the sort of stuff an executive, purchasing agent, engineer or foreman will want in a hurry.

BRADY VS. KNIGHT

Number of Entries—The preponderance here in favor of Brady is overwhelming. His index lists 8,821 items while Knight's has less than 1,100. But Knight is probably close to accuracy in his claim that his book has "the basic facts on 90 percent of commodities used in industry."

Ease of Use—Knight wins hands down. His information is easier to find and easier to read.

Trade Names—Brady has lots, Knight few. That is an important point if you have to do much tracking down of tradenamed goods and gunks.

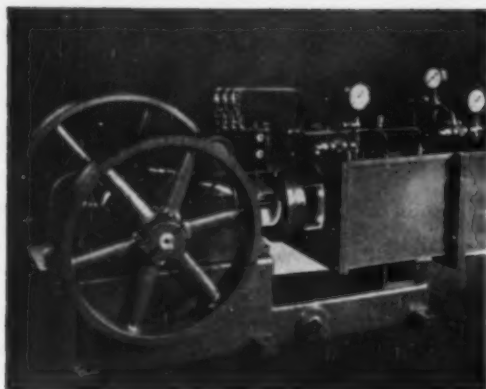
Price—Brady is nearly twice as much as Knight. But he is less than a cent per page while Knight is well over 14c.

Conclusion—Take your choice; pay your money. The probability is that if you want either, you want both.

Knight for easy reading of accurate

(Continued)

* Materials Handbook. Seventh edition. By George S. Brady. McGraw-Hill Book Co., New York. 913 pages. \$8.50.
Materials Buying Manual. By Harold A. Knight. Conover-Mast Publications, New York. 340 pages. \$4.50.



3-Stage acetylene compressor with steel base. Cylinders are submerged in water in this hopper type Norwalk compressor.



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BOOKSHELF, cont. . .

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No Solids

LIQUID EXTRACTION. By Robert E. Treybal. McGraw-Hill Book Co., New York. 442 pages. \$7.50.

Reviewed by M. J. P. Bogart.

First in its field since 1937, this book presents an excellent and thorough compilation of material widely scattered throughout the technical literature. It can be employed both as a text for the teaching of this subject and as a reference book for engineers.

The determination and correlation of pertinent liquid-liquid equilibria and the influence of pressure and temperature are amply covered, as well as their estimation from vapor-liquid equilibria. Extraction theory and calculation procedures are presented and supplemented by illustrative problems for single solvents, using either the triangular or solvent content-composition diagrams for single contact, differential, cocurrent and countercurrent multiple contact processes. Similar treatment is given for the use of double and mixed solvents.

In addition, the book deals in detail with the subjects of liquid diffusivities and mass transfer in discrete and continuous contact types of apparatus, a clear exposition being given of the rigorous and simplified transfer unit concepts. A chapter is devoted to the criteria influencing the selection of suitable extraction solvents. The numerous types of extraction equipment employed are discussed and the avail-

RECENT BOOKS RECEIVED

The Chemistry of Uranium, Part I. By I. J. Katz & E. Rabinowitch. McGraw-Hill. \$7.25.

Continuous Processing of Fats. By M. K. Schwitzer. Leonard Hill, Ltd. 30s.

Industrial Medicine on the Plutonium Project. By R. S. Stone. McGraw-Hill. \$6.25.

Industrial Oil and Fat Products. 2nd ed. By A. E. Bailey. Interscience. \$15.

An Introduction to Organic Chemistry. 7th ed. By B. Harrow & P. M. Apfelbaum. Wiley. \$5.

Introductory College Chemistry. 5th ed. H. N. Holmes. Macmillan. \$4.75.

Materials Buying Manual. By H. A. Knight. Conover-Mast. \$4.50.

Organic Reactions. Vol. VI. By R. Adams. Wiley. \$8.

Preparation of Organic Intermediates. By D. A. Shirley. Wiley. \$6.

Quantum Mechanics of Particles and Wave Fields. By A. March. Wiley. \$5.50.

Six Membered Heterocyclic Nitrogen Compounds With Four Condensed Rings. By C. F. H. Allen. Interscience. \$10.

Water Supply and Treatment. 7th ed. By C. P. Hoover. National Line Assn. \$1.37.

July 1951—CHEMICAL ENGINEERING

able information on their throughput capacities and mass transfer rates summarized and reviewed. Specific applications of liquid-liquid extraction to petroleum and vegetable oil refining, production of antibiotics, and miscellaneous manufacturing processes are discussed.

Professor Treybal has performed a valuable service in eliminating much of the existing confusion in extraction nomenclature. He also presents a valuable review of the treatment of vapor-liquid equilibria, including the concept of hydrogen bonding as it affects the selection of solvent types, that will be found useful for non-ideal distillation as well. The book does not deal with the extraction of solids. It is to be hoped that future editions will be made even more complete by the addition of this subject.

One Subject, Two Approaches

THE PHASE RULE AND HETEROGENEOUS EQUILIBRIUM. By John E. Ricci. D. Van Nostrand Co., Inc., New York. 505 pages. \$12.

PRINCIPLES OF PHASE EQUILIBRIA. By F. E. W. Wetmore and D. J. LeRoy. McGraw-Hill Book Co., New York. 200 pages. \$3.50.

Reviewed By G. F. Kinney

The two new volumes are marked by a common subject matter but a great difference in approach. Ricci begins with a study of the meaning and implications of the phase rule, with attention to such basic problems as what constitutes a phase. He points out that a phase can best be defined in terms of phase-rule variables, and that these in turn are best defined in terms of phases. Wetmore and LeRoy, on the other hand, begin with concise definitions of phase, component, equilibrium, etc., and proceed immediately with the study of simpler systems.

"The Phase Rule and Heterogeneous Equilibrium" is a scholarly and at times lengthy treatise on the fundamental yet deceptively simple principles of phase behavior and of phase diagrams. Initial consideration is for one-component systems and for binary systems with continuous miscibility in all states. The complications introduced by a miscibility gap are then considered. This approach is somewhat non-conventional, but it avoids philosophical difficulty associated with the problems of complete immiscibility in the solid state. These problems are discussed, as are those of more complex situations such as reciprocal (Continued)

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BOOKSHELF, cont. . .

ternary systems, additive quarternary systems, and quinary aqueous systems. The material is supplemented by a large number of simple yet adequate sketches, and many references to both current and older literature are provided. Appended is a list of general references and an index to the systems treated in the text.

"The Principles of Phase Equilibria" is a new title for the International Chemical Series. It is primarily an introductory text for graduate and undergraduate students. Systems of two, three and four components are covered. A portion of the material is devoted to some of the more immediate practical considerations such as those of concern in the operations of distillation and crystallization.

Technique

ADSORPTION AND CHROMATOGRAPHY. By Harold G. Cassidy. Interscience Publishers, New York. 360 pages. \$7.

Reviewed by F. C. Nachod

Professor Cassidy who has been interested in adsorption phenomena for many years is well qualified to cover this topic in Vol. V of Dr. Weissberger's "Technique of Organic Chemistry" series. The development from the molecular aspects of adsorption, treatment of data, phase and absorptive properties, eluents and adsorbents, nature of separation properties, batchwise, decolorization, chromatography and practical units is logical and extensive. Chemists who are faced with the task to "clean up a compound" will do well to consult Dr. Cassidy's monograph. The only adverse comment is that no effort was made to describe industrial applications such as commercial dehumidification or industrial decolorization but this is a minor complaint.

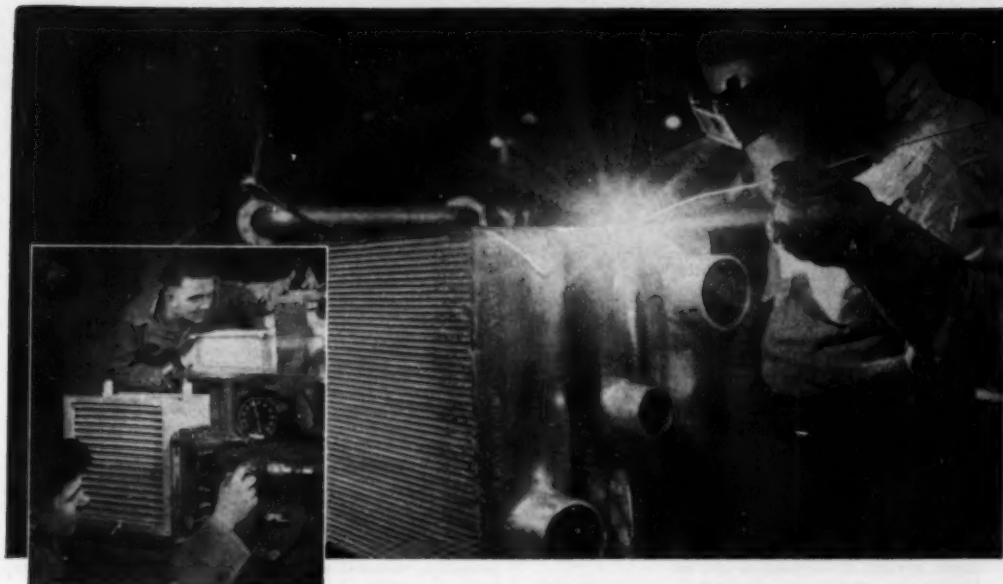
More Than Rocket Fuel

THE CHEMISTRY OF HYDRAZINE. By L. F. Audrieth and B. A. Ogg. John Wiley & Sons, New York. 244 Pages, \$5.

Reviewed by Charles C. Clark

Purpose of the book is to summarize. It is well written and admirably presents a subject that is beginning to gain the interest of chemists and chemical engineers in the industrial field. The emphasis is on the inorganic chemistry of this substance. Where organic reactions are discussed the organic chemist will miss his

(Continued)



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Here are the simple facts about Trane *Brazed Aluminum Surface*—a new type of heat exchanger now available for the chemical and process industries:

1. Much lighter than conventional fin-and-tube heat transfer equipment.
2. So strong it has been successfully tested at pressures up to 1000 pounds per square inch. Has withstood 2 million reversals at 100 pounds pressure.
3. Packs up to 450 square feet of total surface in a cubic foot of volume—up to nine times the surface of a comparable volume of $\frac{3}{4}$ " tube shell-and-tube heat exchanger.
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Trane *Brazed Aluminum Surface* can be used for gas to gas, gas to liquid, or liquid to liquid heat transfer. Complete flexibility creates almost unlimited possibilities for its use.

Trane *Brazed Aluminum Surface* will meet practically any specification of heat transfer, pressure drop, volume, number and direction of passes and velocity of fluids.

Trane *Brazed Aluminum Surface* has been completely tested in numerous applications. During the last war, hundreds of aircraft engines were cooled with Trane Aluminum Radiators—one of the earlier forms of the new brazed aluminum surface.

Certain limitations exist on this surface. It is available only in aluminum at present. Small quantities are not economical.

This new development is but a part of the extensive Trane line of heat transfer equipment. Also included is shell-and-fin-tube and fin-tube surface in a wide variety of combinations, tube sizes and materials. If you have a knotty heat transfer problem you may find the answer in the Trane line. Contact the Trane Sales Office nearest you or write direct.

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TRANE

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ubiquitous structural formulas. The authors point out that the recent increase in interest in hydrazine arises from the German development of this product as a rocket fuel during World War II, the research carried out by the Office of Naval Research and the commercial development going on at present.

Chemical engineers should be particularly interested in the chapters describing the manufacture of hydrazine by the Raschig synthesis from hypochlorite and ammonia and its subsequent concentration. From the chemical engineering standpoint the absence of a process flow diagram is felt in the description of the Raschig process. There is also a fine collection of data on physical and thermodynamic properties. It would seem better to express the small decimal factors in the thermodynamic equations as negative powers of ten than as decimal fractions. The discussions of bond energies, gaseous decomposition and explosive characteristics are interesting. The intriguing and variable behavior of hydrazine on oxidation by different oxidizing agents, some giving hydrazoic acid, some ammonia and some nitrogen as the principal products is set forth. Catalytic decomposition also is included.

The analytical chemist will find the description of the quantitative and qualitative detailed methods very useful.

The section on hydrazine salts and coordination compounds offers many interesting features to the research chemist.

Reactions in anhydrous hydrazine and conductivity and potential measurements made in this fascinating solvent are discussed. The difficulties of working in anhydrous hydrazine and of preparing it are pointed out.

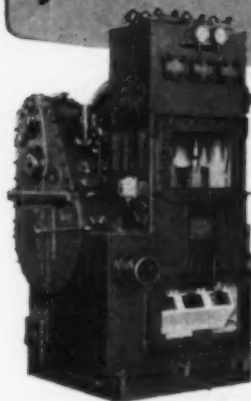
No doubt chemical engineers will be considerably interested in the last chapter which discusses uses for hydrazine. For most uses, free hydrazine or even a water solution is not needed. In the majority of cases, salts of inorganic or organic acids or organic derivatives are used. Some uses include antioxidants, photographic chemicals, reducing agents for metal salts to make mirrors or catalysts, explosives, insecticides, plasticizers, wetting agents, dyes and medicinals. The authors point out that the main deterrent to the more extensive development and use of hydrazine and its derivatives is cost.

One is impressed by the abundance of references to the literature. Many patent references are given at the end of the chapter on uses. —End

Recent Books & Pamphlets

Subject	Summing Up	Ordering Data
Research	Lists current research projects in 91 member colleges and universities. For each institution: names of research administrative officers; digest of policies governing projects and contracts; number of personnel engaged in research; annual expenditures; special conferences and short courses of interest to research workers. 244 pages.	"Review of Current Research and Directory of Member Institutions." 1951 edition Secretary, Engineering College Research Council, Rm. 7-204, 77 Massachusetts Ave., Cambridge 39, Mass. \$2.25.
Intermediate	N-Bromosuccinimide. Substitution, dehydrogenation, addition, oxidation and abnormal reactions. Uses in introduction of double bonds, increasing chain length. Special applications in the field of steroids. 42 pages.	"N-Bromosuccinimide, Its Reactions and Uses." By T. D. Waugh. Arapahoe Chemicals, Inc., 2800 Pearl St., Boulder, Colo. Gratis.
Isotopes	How the AEC's program for distribution of radioactive and stable isotopes is set up. Products, their properties and prices, procurement procedures, technical and informational services of the commission. 74 pages.	"Isotopes, Catalog and Price List No. 4." March 1951. U. S. Atomic Energy Commission, Isotopes Division, P. O. Box E, Oak Ridge, Tenn.
Aluminum	Existing reduction plants in the Northwest, utilization of electric energy, raw material supply lines, markets. Future avenues of expansion. 28 pages.	"Aluminum Industry of the Northwest." By J. G. Jensen. Oregon State Engineering Experiment Station, Corvallis, Ore. 25 cents.
Research	What Alberta's government is doing to develop such resources as bituminous sands, coal, natural gas. 40 pages.	"Report of the Research Council of Alberta, 1950." No. 60. Secretary, Research Council of Alberta, University of Alberta, Edmonton, Canada.
Buyer's Guide	British manufacturers of processing equipment. Firms are listed by name and by products and services. Illustrated section catalogs products. 300 pages.	"British Chemical Plant, 1951." British Chemical Plant Manufacturers Assn., 14 Suffolk St., London, S.W.1, England.
Corn Products	Charts show where products are utilized in fields of food, clothing, medicine, arms and equipment. 8 pages.	"Essentiality of Corn Products to the Arm Forces." Corn Industries Research Foundation, 5 East 45th St., New York, N. Y.
Maintenance	Specialized discussions on chemical plants, electrical equipment, paper, food processing and metal working plants. Papers by over 40 experts on such subjects as preventive maintenance, inspection procedures and frequencies, applied lubrication in industry. 228 pages.	"Techniques of Plant Maintenance—1951." Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. \$0.
Fire Prevention	Designed fire prevention—planning in the drafting board stage, in maintenance and in personnel education to prevent and control fires. 10 pages.	Reprint No. 178, Editorial Dept., Chemical Engineering, 330 West 42nd St., New York 18, N. Y.
Naval Stores	Discussion of the industry looking forward to probable supplies and prices of both rosin and turpentine.	"Naval Stores Review and Outlook," April 1951. Dept. of Agriculture, Washington 25, D.C. —End

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Controllable Capacity Pump.

APPLICATIONS

Among many liquids handled by Aldrich Pumps are: caustic solutions, fatty acids, nitric acid, acetic acid, aqueous ammonia, anhydrous ammonia, as well as liquids encountered in the petroleum refining, petroleum chemical, and other industries.



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This calls for an Aldrich-Groff "POWER-SAVR"—a variable stroke triplex pump which controls delivery from 0 to 100% capacity at constant pump and motor speed. Control can be accomplished from any remote point, manually or automatically. Power consumption is almost directly proportional to demand. Units handle any free-flowing liquid at discharge pressures from 300 to 15,000 psi and are available in six sizes: from 2" to 6" stroke and from 5 to 125 bhp. Request Data Sheet 65.

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From our experience in building pumps for the chemical industry, we can—from our engineering and service files—frequently make specific recommendations to meet your chemical pumping needs . . . whether your problem involves corrosion, high viscosity or high pressure.

Any or all of the above Data Sheets are available on request.

Aldrich Accumulators are also available to meet your displacement requirements. For information on hydro-pneumatic and weight-loaded types, request Data Sheets 29, 29A.



THE ALDRICH PUMP COMPANY
3 GORDON STREET • ALLENTOWN, PENNSYLVANIA

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Direct Flow Pump

Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit
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inactivate metallic contaminants by sequestering with Pfizer **Gluconic Acid**

Unwanted traces of iron, aluminum, copper and other metals picked up from pipe lines and processing equipment can be rendered inactive by the use of small amounts of gluconic acid. This non-toxic, non-volatile, non-corrosive acid acts as an effective sequestering agent...makes it all but impossible to detect the metal impurities by common analytical procedures.

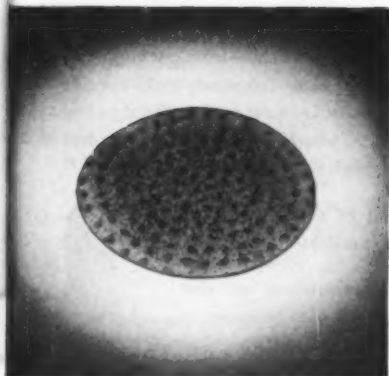
Gluconic acid prevents the precipitation of metallic cations at pH values ranging from 4.5 to relatively high caustic solutions. In the case of calcium and magnesium it has been proven particularly effective as a sequestering agent in relatively strong—3%—caustic concentrations.

One of the mildest acids available, gluconic acid is used as a sequestering agent in many processes including textile printing, industrial water treatment and tanning, and in detergent formulations. It is marketed as an amber, 50% aqueous solution possessing a slight acetous odor, and has a specific gravity of 1.24 at 25°C.

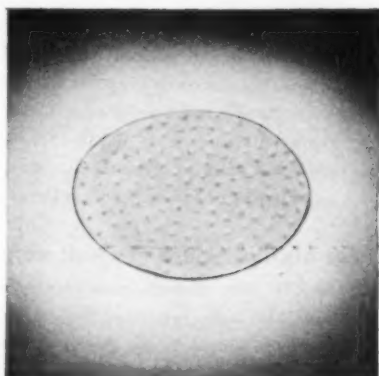
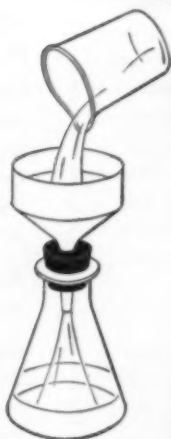
Write our Technical Service Department today for complete information, samples and prices.



PFIZER



Without Gluconic Acid



With Gluconic Acid

A small amount of gluconic acid was added to one of two beakers containing an iron solution. Both solutions were made alkaline by the addition of caustic soda. In the case of the solution without the gluconic acid, a precipitate of ferric hydroxide was formed. The solution with the gluconic acid remained clear even though adjusted to the same alkalinity.

GLUCONIC ACID

AMMONIUM GLUCONATE • CALCIUM GLUCONATE • COPPER GLUCONATE • FERROUS GLUCONATE • MAGNESIUM GLUCONATE
MANGANESE GLUCONATE • POTASSIUM GLUCONATE • SODIUM GLUCONATE

CHAS. PFIZER & CO., INC., 630 PLUSHING AVE., BROOKLYN 6, N. Y.; 425 NORTH MICHIGAN AVE., CHICAGO 11, ILL.; 403 THIRD ST., SAN FRANCISCO 7, CALIF.

Big Sulphuric Output Aggravates a Shortage

Almost 13 million tons of acid may be produced this year if current output is continued. Result: sulphur stocks are dropping again. Allocation is here.

Production of chemicals is still breaking through the former record peaks of operation. The tremendous volume of business is reflected in the output of most basic organic and inorganic chemicals.

No exception, sulphuric acid plants in the first quarter of 1951 turned out more acid than we produced in the entire year of 1934. By June we had produced more acid during 1951 than we turned out in any prewar year. March production was close to the annual rate 13.1 million tons of new acid. In addition to the new acid we fortified and recovered spent acid at the rate of 995,000 tons per year. All this in spite of the fact that brimstone sulphur shipments to domestic customers have been cut to only 85 percent of the amount shipped to them during the year ending September 1950. Of course there have been some allowances made for needs of new acid capacity, but from these figures it is evident that the consumers are digging deep into stocks. They hope that their operations will be sufficiently vital to the national economy to force supplementary shipments of brimstone to their plants in order to keep them humming.

Sulphur executives like Langbourne Williams, president of Freeport Sulphur, are pointing out that the brimstone operations are currently operating at an all-out rate and the total supply of brimstone from Frasch mines will not be much greater than the record 5.2 millions long tons turned out in 1950. Last year the overseas exports cut our domestic supply back to 1.1 million long tons. Even with export quotas in effect at the present time, we are moving sulphur out of the country at the rate of 960,000 long tons during 1951. British and French firms are the major overseas users of this chemical raw material, using half of this total. They turned away from their traditional pyrites burning operations and the use of Sicilian sulphur because our brimstone was cheaper and easier to use in sulphuric acid operations.

The vast supply of the element present in various parts of the world, Mr. Williams points out, means that we will not run out of sulphur in the sense that we can not get some minerals at any price, but it does mean that eventually we are going to have to turn to the more expensive sources if our economy continues to expand. He also explains that the British demands on sulphur alone, if eliminated by encouraging them to turn to other forms of sulphur-bearing materials such as the rich Spanish pyrites mines which are owned by British interest would solve most of the shortage here. But the international currency exchange problem is a difficulty that has to be solved before the Spanish and British interests get together.

BRITISH WANT MORE

British sulphur users have been putting the heat on their government to apply pressure on our State Department to keep the flow of sulphur moving into Britain. As long as most American firms are able to get along with their stocks and the current deliveries, they seem to consider the problem remote and somewhat academic. But as the pinch gets worse Congress can expect an increasing flood of complaints from constituents and local industrial firms. Actually we are producing plenty of brimstone sulphur to satisfy all of our domestic needs.

One of the big reasons behind British reluctance to switch back to pyrites is the factor of higher cost of this material and the very expensive conversion to pyrites-burning operations. (Pyrites burning equipment will cost almost as much as the original contact plant.)

In any event it will take some time for overseas users to erect such equipment even after they have been convinced that it is necessary. So we will have to supply them temporarily if we are going to carry out a strong mutual-aid policy with the North Atlantic Pact countries.

One place that we can cut sulphur

consumption is in acid-using plants. Most plants dump their spent acid and make new acid to replace it. If they could be convinced that at least some of the acid can be recovered and re-used, a big saving in total new acid requirements will be made with no loss in production. Some experts feel that at least 700,000 tons of acid now being dumped could be reclaimed and used again. Other firms might follow the example of Gates Bros. Co.'s superphosphate operations. Here the fertilizer plant uses alkylation acid from refineries to produce the phosphoric acid needed in triple superphosphate.

Some action is needed soon if the current acid production rate is to be maintained. In April the sulphur producers stocks again began to lose ground. They dropped to 2,750,000 in April. This is a slump of 37,000 long tons in one month and is 135,000 long tons below the level maintained at the same time last year.

WHAT NPA IS DOING

The government has issued NPA order M-69 to deal with this problem and starting last month each shipment to a consumer will have to have the approval of the NPA and restricts the use of sulphur to the amount used to a percentage of the base period. All users of sulphur have to report the amount used each month and their inventory. Deliveries will be allocated on a quarterly delivery basis.

During the quarter starting July 1, sulphur producers were allowed to ship the amount stated in their application to NPA unless otherwise notified. In the next quarter, applications for shipment have to be filed a month in advance of the start of the new quarter. The approved forms will be returned at least 10 days before the start of the quarter.

Freeport Sulphur points out that while it is shipping to customers at the rate of 85 percent of purchases made during the year ending in Sept. 30, 1950, this figure was determined before export allocations were increased to 250,000 long tons in the second quarter. Third quarter allocations will probably be larger. If this occurs, Freeport will have to cut back domestic sales.

How the New NPA List Rates Chemicals

Scarce

Acetylene.
Albumin, serum.
Amino phenol.
Ammonium persulfate.
Amyl phenol.
Aniline.
Aniline dyes.
Anthraquinone dyes.
Argon.
Aureomycin.
Benzene dichloride.
Bismuth compounds.
Blood plasma.
Boric acid.
Butyl phenols.
Calcium carbide.
Carbon black.
Carbon dioxide.
Chlorophenol-para.
Chrome green.
Chrome molybdate orange.
Citric acid.
Cortisone.
Copper sulfate.
Crypton.
Cupric aceto arsenite.
Cyclohexylamine.
Dichlorobenzene-para.
Dicyclohexylamine.
Diethylamine.
Digitalis.
Di-isooctyl sebacate.
Dimethyl sulfate.
Diphenylamine.
Ethylene dichloride.
Formaldehyde.
Freon.
Glycerine.
Hexylresorcinol.
Hydrides, metal.
Hydrogen.
Hydrogen peroxide.
Hydroquinones.
Lead chromate.
Litharge.
Lithium hydride.
Lithopone.
Methyl chloride.
Methylene chloride.
Naphthalene.
Nicotinic acid.
Oleum.
Oxygen.
Penicillin.
Phenol.
Phenolic dyes.
Phthalic anhydride.
Pine oil.
Pine tar.
Potassium hydride.
Potassium perchlorate.
Quinoline.
Quinoline acid.
Resorcinol.
Sebacic acid.
Sodium chlorate.
Sulfadiazine.
Sulfathiazole.
Sulfur.
Sulfur components (except chloride).
Sulfuric acid.
Tetramethylthiuramdisulfide.
Tetraethylthiuramdisulfide.
Trichlorethane.
Trichlorethylene.
Triethyl phosphate.
Xenon.

Tight

Acetaldehyde.
Aldrin.
Aluminum chemicals.
Aminophyllin.
Ammonia: Anhydrous, aqua.

Ammonium chemicals (except persulfate).
Antibiotics (except those in Group I).

Antimony chloride.
Antimony trichloride.
Apatite.
Azelaic acid.
Barium chemicals.
Benzene hexachloride (BHC).
Benzene trichloride.
Benzoic acid.
Benzothiazoldisulphide.
Bordeaux mixture.
Borax.
Butyl aldehyde.
Butyl amine.
Butyl carbitol.
Butyl carbitol acetate.
Butyl cellosolve.
Cadmium sulfide.
Calcium chemicals (except carbide and calcium arsenate).
Caustic potash.
Cellosolve acetate.
Chloral.
Chloride of lime.
Chlorine.
Chlorophenol.
Chrome alum.
Chromic acid.
Copper chemicals (except those in I and III).
D. D. T.
Debris.
Detergents, synthetic.
Dethane.
Dibutyl amine.
Dichlorethyl ether.
Dieidrin.
Diethanolamine.
Diethylethanolamine.
Dimethylamine.
Dimethyl phthalate.
Diethyl aselate.
Dithane.
Ethylamine.
Ethyl chloride.
Ethylene diamine.
Ethylene glycol.
Ethylene oxide.
Ferric salts.
Formic acid.
Fumigants.
Helium.
Hexaethyl tetra phosphate.
Hydrobromic acid.
Hydrogen chloride (gas).
Hydrochloric acid.
Isopropyl acetate.
Isopropyl alcohol.
Lanthanum oxide.
Lead chemicals (except lead arsenate).
Lead pigments (except those in Group I).
Lime sulfur solution.
Lithium chemicals (except hydride).
Magnesium chemicals (except sulphate).
Maleic acid.
Manganese chemicals.
Mercury chemicals.
Metaphosphoric acid.
Methanol.
Methylamine.
Methyl carbitol.
Monochlorobenzene.
Monmethanolamine.
Methyl ethyl ketone.
Methyl isobutyl carbinol.
Methyl isobutyl ketone.
Neon.
Nicotin amide.
Nikethamine.
Nitric acid.
Nitro aniline-para.
Nitrochlor benzene-para.
Nitrogen gas.
Nitrous oxide.
Orthophosphoric acid.
Oxalic acid.
Para dichloro benzene.

Parathion.
Pentachlorophenol.
Pentaphen.
Phenolsulfonic acid.
Phosphorus.
Phosphorus chemicals.
Polyphosphoric acid.
Potassium chemicals (except those in I).

Pyrophosphoric acid.
Riboflavin.
Silicon tetrachloride.
Soda lime.
Sodium chemicals (except chloride).
Strontium chemicals.
Sulfonic acid.
Sulfur chloride.
Tetraphosphoric acid.
Thallium sulfate.
Theophylline.
Tin chemicals.
Titanium pigments.
Titanium tetrachloride.
Tricresyl phosphate.
Triethylamine.
Toxaphene.
Tributylxethyl phosphate.
Tumaric acid.
Typhus vaccine.
Vitamin A.
Vitamin B-12.
Zinc chemicals (except zinc phosphide).
Zinc oxide.
Zirconyl nitrate.
Zirconium dioxide.

Available

Acetic acid.
Acetyl toluidine.
Adipic acid.
Allyl alcohol.
Allyl chloride.
Amine benzoic acid.
Aminoethylethanolamine.
Amyl acetate.
Amyl alcohol.
Amyl alcohol, tertiary.
Amyl nitrate.
Anilidine.
Arenic chemicals.
Arsenous acid.
Benzaldehyde.
Benzene sulphonamide.
Benzene sulfonic acid.
Benzoic acid.
Benzoquinone trichloride.
Benzoyl chloride.
Benzyl acetate.
Benzyl alcohol.
Benzyl benzoate.
Benzyl chloride.
Butyl acetate, secondary.
Butyl acetate, tertiary.
Butyl alcohol, tertiary.
Butyl ether.
Butyric acid.
Calcium arsenate.
Carbon tetrachloride.
Casein.
Chlordane.
Chloroacetophenone.
Chloroform.
Copper aceto arsenate.
Copper aceto arsenite.
Crotonaldehyde.
Cyclohexanol.
Cyclohexanone.
Dibutoxyethyl adipate.
Diisooctyl adipate.
Diisopropanolamine.
Diisopropylamine.
Dimethylethanolamine.
Dipentaerythritol.
Diphenyl urea.
Disinfectants.
Dithio carbamate fungicides.
Epichlorohydrin.
Epsom salts (magnesium sulfate).

Esters.

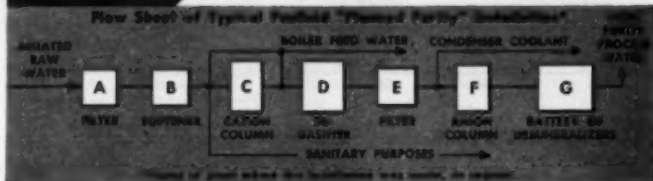
Ethers (except dichlorethyl ether)
Ethyl acetate.
Ethyl alcohol.
Ethylhexanediol.
Ethyl hexyl alcohol.
Ethylene chlorhydrin.
Glycolic acid.
Glycols (except ethylene glycol).
Glyoxal.
Heptanol-3.
Heptanol special.
Hexanol-normal.
Hydriodic acid.
Hydrofluosillicic acid.
Hydrogen sulfide.
Hydroxy benzoic acid.
Hypophosphoric acid.
Insulin.
Iodine.
Iron sulfate.
Iso amyl alcohol.
Iso butyl acetate.
Iso butyl alcohol.
Iso octyl alcohol.
Iso phorone.

Ketones (except methyl ethyl).

Lead arsenate.
Magnesium salts.
Mesityl oxide.
Methyl bromide.
Methyl diethanolamine.
Monoethylamine.
Monoisopropanolamine.
Monoisopropylamine.
Monomethylamine.
Naphtha.
Naphthalene.
Nicotine.
Nicotine sulfate.
Nitro aniline.
Nitrochlorobenzenes.
Nitro ethane.
Nitro methane.
Nitro propane-1.
Nitro propane-2.
Octanol-normal.
Paints.
Para amino benzoic.
Paraformaldehyde.
Paraldehyde.
Para nitro benzoic.
Paris green.
Pentaerythritol.
Perchloroethylene.
Phenolsulphonic acid.
Phthaliall glycolates.
Propionaldehyde.
Propionic acid.
Propyl acetate-normal.
Propyl alcohol-normal.
Propylene chlorhydrin.
Propylene dichloride.
Propylene oxide.
Pyrethrum.
Pyrocatechol.
Quinacrine hydrochloride.
Nicotinic acid esters.
Rodenticides.
Rotenone.
Sabadilla.
Salicylates.
Salicylic acid.
Santonin.
Secondary butyl alcohol.
Shellac.
Soaps.
Soil fumigants.
Starch derivatives.
Succinic acid.
Synthetic detergents.
Toluene derivatives.
Tributylamine.
Triethanolamine.
Triethylamine.
Triethylenetetramine.
Triisopropanolamine.
Trimethylamine.
Tripentaerythritol.
Turpentine.
Vitamins (other than Group II).
Weed killers (herbicides).
Wood preservatives.
Zinc chemicals (other than Group II).



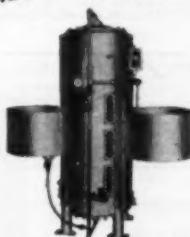
✓ Process Improved
✓ Rejects Decreased
✓ Costs Lowered
✓ Production Increased
with "PLANNED PURITY" WATER



Problem Assigned Penfield: Raw well water of 347 PPM total hardness (calculated as CaCO_3) and 187 PPM alkalinity, methyl orange, as well as considerable hydrogen sulphides, needs to be conditioned for use as follows: 1300 gph for boiler feed water and sanitary purposes; 100 gph for use as make-up water for a condenser coolant; and 2500 gph for a process requiring exceptionally high purity water.

"Planned Purity" Solution: Aerated raw water is passed through Sand Filter (A) to remove colloidal sulphur (precipitated by aeration), then through Softener (B), at which point water of satisfactory softness for sanitary purposes is drawn off. Approximately 3000 gph of softened water passes on to large Cation Column (C) where the cations are removed and the 187 PPM of alkalinity are converted to carbonic acid which can be blown from the water into the Degasifier (D) as carbon dioxide. The degasified water then is pumped through the Sand Filter (E) and on to the Anion Column (F). However, provisions are made (1) for combining water taken from the large Cation Column with equal parts of water taken from the Softener to make an ideal blend for boiler feed use; and (2) for drawing off 100 gph of water demineralized down to approx. 20 PPM total solids, which with small additions of caustic soda is ideal for use as make-up water for a condenser coolant. The remaining water passing through this multiple-use conditioning system goes on to a battery of Demineralizing Units (G) which deliver approximately 2500 gph of the exceptionally high purity water (conductivity of 1,000,000 ohms) required in the plant's process.

NEW! Mono-Bed Unit



The Penfield Mono-Bed Demineralizer shown above operates upon the most efficient and effective demineralizing technique known — the intimate mixing in a single container of cation and exceptionally strong anion base exchangers. In comparison to distilled water costs, Penfield Industrial Demineralizers provide savings as high as 85% and in one reported instance cut costs 95%. Send for "Penfield Purity" facts giving specifications of all Penfield Demineralizing Units — from 10 gals/hr. to 10,000 gals/hr.

LET PENFIELD ENGINEERS MAKE A "PLANNED PURITY" SURVEY OF YOUR PLANT

As in the typical "Planned Purity" installation described above, by planning water-treating methods specifically for the various standards of purity and quantities required, Penfield engineers often are able to suggest a multiple-use conditioning system which, while holding equipment investments to a minimum, makes important contributions both to reduced plant operating costs and to improved process or end product results.

Write today describing your water conditioning needs.

PENFIELD
MANUFACTURING CO., INC.

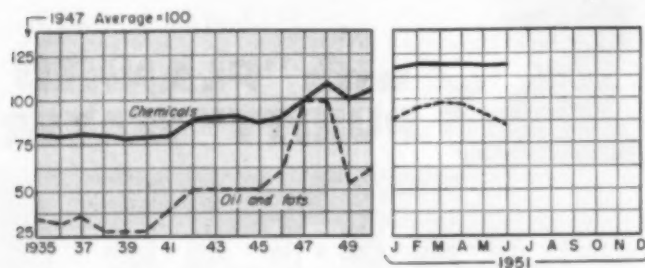
19 High School Ave., Meriden, Conn.

FILTERS • SOFTENERS • DEGASIFIERS • DEMINERALIZERS

Penfield "Planned Purity" PART

Process Industry Trends

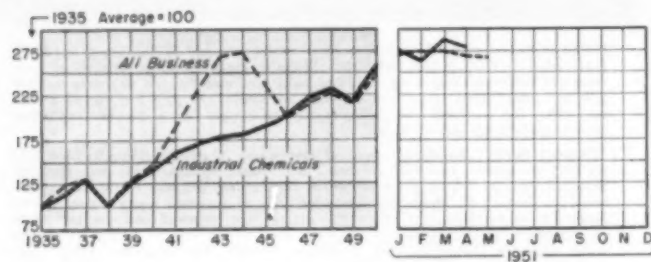
PRICES



Chemical Engineering's Price Indexes

Chemicals - Up	0.01		
Fats & Oils - Down	2.55		
	Chemicals	Oils & Fats	
As of July 1	118.90	80.95	
Last month	118.97	83.50	
July 1950	102.51	54.45	
July 1949	99.90	80.79	

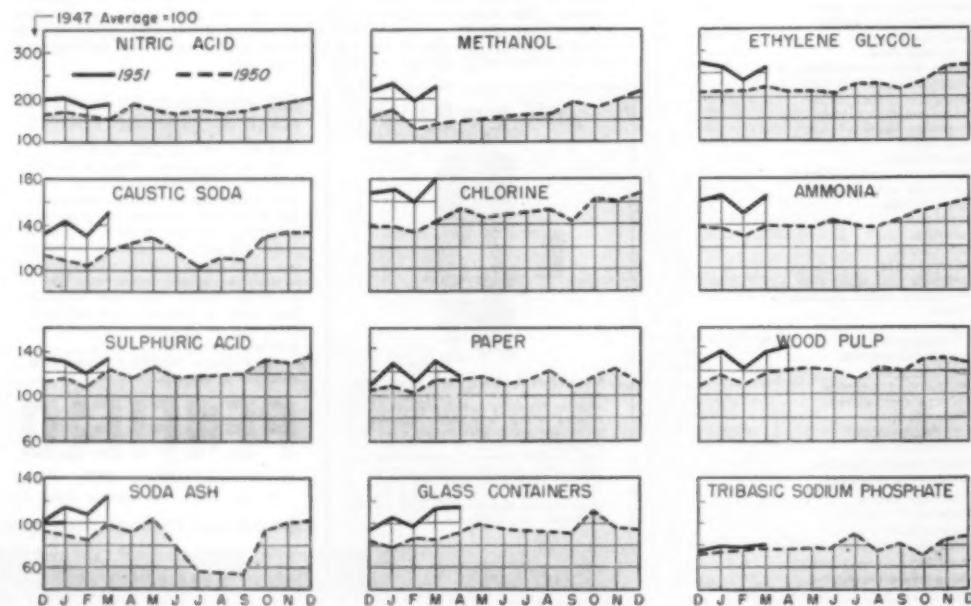
CONSUMPTION



Industrial Chemicals Index

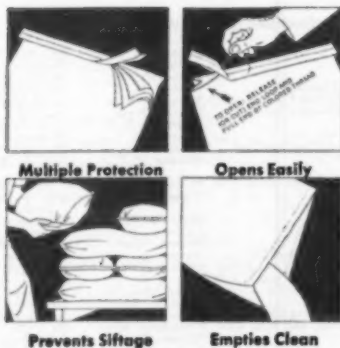
	March (Revised)	April
Fertilizers	66.50	67.88
Pulp and paper	20.60	20.60
Petroleum refining	28.10	24.10
Iron and steel	16.55	16.35
Rubber	32.30	31.15
Glass	24.85	25.15
Paint and varnish	31.05	30.25
Textiles	12.70	13.20
Coal products	11.30	11.03
Leather	4.70	4.90
Explosives	7.87	8.53
Rubber	6.30	6.21
Plastics	17.15	16.10
INDEX	267.97	277.37

PRODUCTION





The time has come
the Walrus said
To talk of many things
of Ships and Planes...Production Pains
and everything it brings



"**E**VERYTHING," in the national emergency, can include whatever you make and ship. Overnight it might mean changes in type of design of your containers.

So the Union Multiwall Specialist (the Walrus, if you like) is ready to help you meet any such problem.

When you invite a Union Multiwall specialist to study your packaging, there's no obligation of any kind. But now, more than ever, you'll find his packaging engineering know-how valuable to you.

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Now Byproduct Hydrochloric Rules the Roost

Organic chemical output is gobbling up chlorine and turning out this acid so fast that old line processes are taking a back seat. Only 25 percent now comes from salt.

A. J. P. WILSON, consulting chemical engineer, Great Neck, N. Y.

Today we get hydrochloric acid from four major processes. They are (1) salt plus sulphuric acid, (2) hydrogen plus chlorine, (3) Hargreaves type operations and (4) organic chlorinations.

By 1950, chlorination of hydrocarbons in the country had reached the point where about 55 percent of our hydrochloric acid comes from this type of organic synthesis. The standard salt and acid process plus the Hargreaves type unit supply about 25 percent of our acid. The units burning hydrogen and chlorine produce the remaining 20 percent.

WHERE IT GOES

Being a relatively cheap chemical, the producing units are spread out all over the country—close to consuming sources. However, in recent years the growing supply of byproduct hydrochloric acid has created an unbalanced situation in some markets. Large tank

barges now haul the acid more than a 1,000 miles to market.

Petroleum takes the largest bite. Industry experts feel that activation of oil wells consumes about 30 percent of the acid sold. Chemical production takes about 23 percent, while metal production uses up almost 13 percent. The food industry uses about 12 percent of this acid, including the production of monosodium glutamate and starch hydrolysis. About 10 percent of the acid is used in metal and general cleaning. Miscellaneous uses take up the remaining 13 percent in the end-use pattern.

Further commercial development of hydrochloric acid is a complex problem since it is tied to the production and sale of salt cake, caustic soda, chlorine and a wide variety of chlorine compounds. A big question mark in the future of hydrochloric acid is the possibility of large scale recovery of chlorine from byproduct acid. If all byproduct acid were converted back to chlorine, it would substantially reduce

the need for electrolytic chlorine. In fact, it might even halve the need of electrolytic chlorine. This would cut down the amount of electrolytic caustic being produced, stimulate lime-soda operations and could reverse the trend toward replacing lime-soda caustic. However, up to this stage, the possibility remains faint and remote. Several patents have been granted on processes that are aimed at this goal and firms like Dow Chemical have achieved some success along these lines, but no great production of chlorine from this source has appeared.

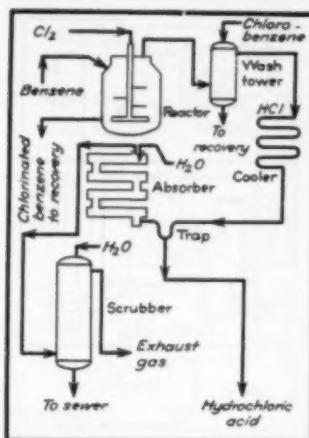
Future production growth of hydrochloric acid seems to be tied to the expansion of byproduct acid. Salt and sulphuric acid process expansion will be restricted by the size of the markets for salt cake.

RECORD PRODUCTION

Output of the acid hit an all-time peak in 1950. Production was 625,373 tons—a growth of 27 percent over the previous year. A study of the increase shows that byproduct acid was responsible for most of the jump, but additional salt plant installed in 1950 helped. For last year's production distribution, see next page.

These plants use four major processes to make more than 625,000 tons of hydrochloric acid a year.

Company	Location	Method
American Cyanamid Co.	Warrens, N. J.	Salt + H ₂ SO ₄
American Agricultural Chemical Co.	Detroit, Mich.	Salt + H ₂ SO ₄
Bay Chemical Co.	Weeks, La.	Hargreaves
Belle Alkali Co.	Belle, W. Va.	Byproduct
Bensol Products Co.	New Brunswick, N. J.	Byproduct
Brown Co.	Berlin, N. H.	H ₂ + Cl ₂
Carbide and Carbon Chemicals Corp.	South Charleston, W. Va.	Byproduct
Celanese Corp. of America.	Newark, N. J.	Byproduct
Chemical Products Corp.	Carterville, Ga.	Byproduct
Cincinnati Chemical Works	Norwood, Ohio	Byproduct
Consolidated Chemical Industries	Fort Worth, Tex.	Salt + H ₂ SO ₄
Cornwell Chemical Corp.	Houston, Tex.	Salt + H ₂ SO ₄
Diamond Alkali Co.	Cornwells Heights, Pa.	Salt + H ₂ SO ₄
Dow Chemical Co.	Painesville, Ohio	H ₂ + Cl ₂
E. I. du Pont de Nemours & Co.	Houston, Tex.	H ₂ + Cl ₂ and Byproduct
	Midland, Mich.	H ₂ + Cl ₂ and Byproduct
	Freeport, Tex.	H ₂ + Cl ₂ and Byproduct
	Pittsburg, Calif.	H ₂ + Cl ₂ and Byproduct
	East Chicago, Ind.	Salt + H ₂ SO ₄
	Cleveland, Ohio	Salt + H ₂ SO ₄
	Lockland, Ohio	Salt + H ₂ SO ₄
	Louisville, Ky.	Salt + H ₂ SO ₄
	Granville, N. J.	Salt + H ₂ SO ₄
	Niagara Falls, N. Y.	Byproduct
	Deepwater, N. J.	Salt + H ₂ SO ₄
	King, N. J.	Byproduct
	Baton Rouge, La.	Salt + H ₂ SO ₄ and Byproduct
	Midland, Tex.	H ₂ + Cl ₂
	Louisville, Ky.	H ₂ + Cl ₂
	Rosenau, N. Y.	Byproduct
	Bay Point, Calif.	Salt + H ₂ SO ₄
	Hegewisch, Ill.	Salt + H ₂ SO ₄
	Marion Hook, Pa.	Salt + H ₂ SO ₄
	Newell, Pa.	Salt + H ₂ SO ₄
	Buffalo, N. Y.	Salt + H ₂ SO ₄
	Pittsfield, Mass.	Byproduct
	Hattiesburg, Miss.	Byproduct
	Hopewell, Va.	Salt + H ₂ SO ₄
	Parlin, N. J.	Byproduct
	Brunswick, Ga.	Byproduct
	Garfield, N. J.	Byproduct
	Ashland, Ohio	Byproduct
	Tacoma, Wash.	H ₂ + Cl ₂
	Niagara Falls, N. Y.	H ₂ + Cl ₂ and Byproduct
	Kobus, Pa.	Byproduct
	Niagara Falls, N. Y.	H ₂ + Cl ₂
	Rahway, N. J.	Salt + H ₂ SO ₄ and Byproduct
	St. Louis, Mo.	Byproduct
	Monanto, Ill.	Salt + H ₂ SO ₄ and Byproduct
	Nitro, W. Va.	Byproduct
	Annisson, Ala.	Byproduct
	Everett, Mass.	Salt + H ₂ SO ₄
	Newark, N. J.	Byproduct
	Buffalo, N. Y.	Byproduct
	Monrovia Chemical Co.	National Aniline Div., Allied Chem. & Dye Corp.
	Navy Chemical Co.	Navy Chemical Co.
	Osark-Mahoning Co.	Osark-Mahoning Co.
	Pennsylvania Salt Mfg. Co.	Pennsylvania Salt Mfg. Co.
	Pittsburgh Plate Glass Co.	Pittsburgh Plate Glass Co.
	Rohm & Haas Co.	Rohm & Haas Co.
	Sharples Chemicals, Inc.	Sharples Chemicals, Inc.
	R. C. Smith Chemical Co.	R. C. Smith Chemical Co.
	Sulphur Process Div., Allied Chemical and Dye Corp.	Sulphur Process Div., Allied Chemical and Dye Corp.
	Solvent Chemical Co.	Solvent Chemical Co.
	Standard Chlorine Chemical Co.	Standard Chlorine Chemical Co.
	Stauffer Chemical Co.	Stauffer Chemical Co.
	Tennessee Products & Chemical Corp.	Tennessee Products & Chemical Corp.
	Tin Processing Corp.	Tin Processing Corp.
	U. S. Industrial Chemicals, Inc.	U. S. Industrial Chemicals, Inc.
	U. S. Rubber Corp.	U. S. Rubber Corp.
	U. S. Vanadium Corp.	U. S. Vanadium Corp.
	Wyandotte Chemical Corp.	Wyandotte Chemical Corp.
	Wilson & Co.	Wilson & Co.
	Malden, Mass.	Byproduct
	Kearny, N. J.	Byproduct
	Stags, Calif.	Salt + H ₂ SO ₄
	Chattanooga, Tenn.	Byproduct
	Texas City, Tex.	Byproduct
	Baltimore, Md.	Byproduct
	Naugatuck, Conn.	Byproduct
	Babco, Calif.	Byproduct
	Wyandotte, Mich.	Salt + H ₂ SO ₄
	Calumet, Ill.	Salt + H ₂ SO ₄



More than half our HCl is a byproduct.

Method	Short Tons (100 percent HCl)
Salt	155,864
Chlorine plus hydrogen...	125,071
Byproduct	344,438
Total	625,373

PRICE TREND

Along with most chemicals the price of hydrochloric acid showed an increase in recent months. It averaged \$23.69 per ton for the 20 Be. grade in New York during 1950. At the end of the year it was selling for about \$30.60 and the current price is \$31.

PROCESSES

Standard method of producing hydrochloric acid has been the reaction of sodium chloride and sulphuric acid in a Mannheim or Laury furnace. The products are hydrogen chloride and salt cake. In this process about 1.85 lb. of salt cake is produced with each pound of 20 Be. acid. The Mannheim furnace is made up of a circular muffle with a dished top and bottom. Salt and 60-Be. sulphuric acid or an equivalent amount of niter cake are charged into the top of the furnace which is equipped with a rake-type agitator. The furnace is slowly heated to a temperature just below fusion point of salt. The HCl is driven off and is fed into a cooling and condensing system. Then it is run into absorbers. The gas passes through a stoneware line to a stone box where it leaves entrained sulphuric acid. Then it enters the coolers that are externally cooled with a water stream. In the stoneware absorbing towers the acid solution is brought up to desired concentration. From three to five towers may be used to complete the absorption. In some plants "S" coolers or Cellerius vessels are used to supplement the towers in cooling and absorption operations.

(Continued)

This announcement is not to be construed as an offer to sell or as an offer to buy the securities herein mentioned. The offering is made only by the Prospectus.

NEW ISSUES

CHAS. PFIZER & CO., INC.

150,000 Shares 4% Cumulative Second Preferred Stock, \$100 Par Value
(Convertible into Common Stock until June 30, 1956)

Price \$101.50 per Share

444,015 Shares Common Stock, \$1 Par Value

Transferable Subscription Warrants evidencing rights to subscribe for these shares of Common Stock have been issued by the Company to holders of its Common Stock. Such Warrants expire at 3 P.M., Eastern Daylight Saving Time, on July 10, 1951, as more fully set forth in the Prospectus.

Subscription Price to Warrant Holders

\$33 per Share

Copies of the Prospectus may be obtained from the undersigned only in states in which the undersigned is qualified to act as a dealer in securities and in which the Prospectus may legally be distributed.

F. EBERSTADT & CO. INC.

June 27, 1951

These Securities were placed privately through the undersigned with institutions purchasing them for investment. They are not offered for sale and this announcement appears as a matter of record only.

NEW ISSUES

Victor Chemical Works

\$9,000,000

3% Promissory Notes, due in 1970

100,000 Shares

4% Cumulative Second Preferred Shares

\$50 Par Value

(Convertible into Common Shares for a specified period)

F. EBERSTADT & CO. INC.

June 22, 1951.

TABER for Higher PRACTICAL Performance

8-591



PUMPING MIXED ACIDS...

Oleum, concentrated sulphuric, mixed acids and similar liquids, are well within the handling range of Taber Vertical Pumps. • With Taber Stuffing Box located away from fluid being handled, **REPACKING INTERRUPTIONS** are reduced to an inconsiderable minimum. • Liberal size bearings and oversize shafts retard vibration and extend the useful life of these Taber Vertical Pumps. • Pump can be furnished in all grades of nickel chrome alloys, iron, bronze or carbon steel obtainable . . . whichever customer has found most suitable. • Please use business stationery when writing for Complete BULLETIN V-837.



TABER PUMP CO. (Est. 1859) 294 Elm St., Buffalo 3, N. Y.

TABER PUMPS

Of course...
Another Syntrol
Electric Vibrator

Another
Free-Flowing
Hopper

This V-25 Electric Vibrator on hopper supplying bucket elevator keeps material flowing freely, without surges, and without periods of coming "short."

SYNTRON ELECTRIC VIBRATORS

With Variable Control of Power

3600 controllable vibrations per minute keep even the most stubborn materials flowing freely thru bins, hoppers, chutes and screens . . . **WITHOUT THE HAMMERING AND RODDING AND POKING THAT WASTES MANPOWER AND DAMAGES EQUIPMENT.**

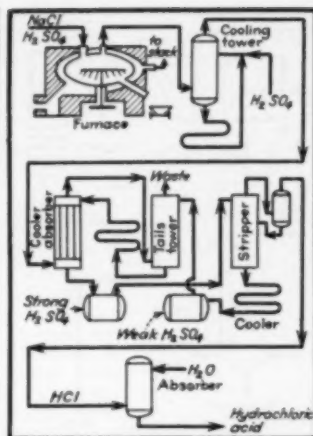
For 1 cu. ft. hoppers up to large storage bunkers.

Write To—

SYNTRON COMPANY

819 Lexington Avenue

Homer City, Penna.



Old-line process uses salt and acid.

COMMODITY SURVEY, cont. . .

Hydrogen and chlorine are reacted as follows to produce hydrogen chloride. Hydrogen gas and chlorine which has been preheated are fed to a hydrogen chloride burner set in the base of a chamber. The chamber is water cooled. About 17.3 lb. per hr. of hydrogen and 585 lb. per hr. of chlorine are fed to the burner to produce about 600 lb. per hr. of HCl. The product is then treated to produce the desired grade of acid after cooling.

Byproduct acid is obtained in chlorinating many organics. The accompanying flowsheet shows how HCl can be recovered from such an operation. Basic steps in such production include the removal of any unchlo-

Cost Factors Salt Plus Sulphuric Acid Process Plant

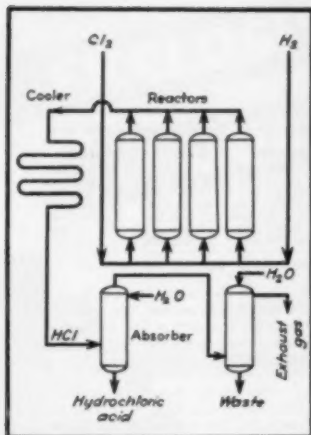
Basins: 5 Mannheim furnaces
Investment: \$1,400,000
Capacity: 27.5 tons 100% HCl
(94 tons 20 lbs. acid)
82.5 tons 100% NaHSO₄
(88 tons 90% NaHSO₄)

Operating Cost per Day

Raw materials	
Salt, 57 tons	\$250
Sulphuric acid, 36 tons	\$798
Labor	
Operators, 72 man-hr.	\$120
Laborers, 48 man-hr.	60
Supervision & overhead	93
Power	16
Water	212
Maintenance	424
Depreciation @ 10%	85
Ins. & taxes	760
Selling & admin.	
Total cost	\$2,835

Prices and Profits

Sales	
HCl, 94 tons @ \$31	\$2,914
NaHSO ₄ , 82.5 tons @ \$17	809
Total sales	\$3,723
Ratio, cost/price	74.37%
Per ton HCl	
Price	\$31.00
Cost (\$31 x 74.37%)	\$23.05
Gross Profit	\$ 7.95
Income taxes @ 70%	5.56
Net Profit	\$ 2.40



H₂ plus Cl₂ burners make acid and gas.

minated hydrocarbon, and then the absorption of the HCl in water.

Another method employed in this country is the Hargreaves process, wherein a wet stream of SO₂ containing some SO₃ passes over lumped salt in pans which are placed in a chest. The only plant operating on this process is the Bay Chemical plant at Weeks Island, La. However, Potash Co. of America is currently running a unit at Dumas, Tex., which uses a modified version.

Cost Factors Hydrogen Plus Chlorine Process

Chlorine Plant

Basia: 50 ton per day electrolytic plant
Capacity: 50 tons Cl₂
Investment: \$5,000,000

Chlorine Cost per Day

Raw material.....	\$37.3
Power.....	667
Labor.....	296
Supervision & overhead.....	148
Purification.....	6
Depreciation, 10%.....	1,515
Maintenance.....	717
Ins. and taxes.....	303
Selling and admin.....	979
Total cost.....	\$4,974

Sales	
Cl ₂ 50 tons @ \$54.....	2,700
NaOH, 56.4 tons @ \$56.....	3,188
Total sales.....	5,888

Chlorine Cost per Ton

Total sales per day.....	\$5,888
Total cost per day.....	\$4,974

Gross profit on 50 tons.....	\$894
Ratio: profit/sales.....	15.1%
Cl ₂ selling price per ton.....	\$54.00
Profit (84 X 15.1%).....	\$8.18

Cost per ton Cl ₂	\$45.85
------------------------------------	---------

HCl Cost per Ton

Cl ₂ (1/3 ton @ \$45.85).....	\$15.28
Burning costs.....	2.08
Cost of 30 lbs. HCl, per ton.....	\$17.33
Price.....	\$31.00
Gross profit.....	\$13.67
Income taxes @ 70%.....	9.57
Net profit.....	\$4.10

CHEMICAL ENGINEERING—July 1951

More Wearing Comfort--
More Willingness to Wear

The NEW WILLSON "800" Series Chemical Cartridge Respirators



1. Lightweight, molded rubber facepiece—soft, snug-fitting comfort.
2. Resilient, rolled, feathered edge—tight, effective seal.
3. Flexible, molded chin cup—comfortable and secure.
4. Adjustable, elastic head and neck bands.
5. Self-adjusting fit over bridge of nose—without reinforcement.
6. Improved exhalation valve—located out of the way at bottom of respirator.
7. Dual chemical cartridges—absorb and chemically filter gases and vapors in low concentrations. Organic vapor cartridges approved by U. S. Bureau of Mines.
8. Large filtering areas—easy breathing with minimum resistance.



WILLSON
Established 1917

See your WILLSON Distributor
or write us direct.

WILLSON PRODUCTS, Inc., 106 Thorn Street, Reading, Pennsylvania

New Construction

Proposed Work

Ariz., Rillito—Arizona Portland Cement Co., Rillito, plans to enlarge its plant. Estimated cost \$2,945,758

Calif., Sacramento—Procter & Gamble Co., Ivorydale, Cincinnati, O., plans to construct a 6 story processing plant and 2 story production plant for soap and special detergents. Estimated cost \$10,000,000

Ca., Rockmart—Southern States Portland Cement Co., Rockmart, plans to construct plant additions. Estimated cost \$5,000,000

Ky., Louisville—Aetna Oil Co., Inc., 1202 S. 3rd St., plans to construct an addition to its plant. Estimated cost \$6,000,000

La., Baton Rouge—Continental Oil Co., West Lake via Baton Rouge, plans to triple the capacity of its crude oil refinery. Estimated cost \$23,000,000

O., Toledo—Pure Oil Co., 35 East Wacker Dr., Chicago, Ill., plans to construct a catalytic cracking unit at Toledo refinery. Estimated cost \$7,400,000

Pa., Pottstown—Firestone Tire & Rubber Co., 1200 Firestone Pkwy., Akron, O., plans to construct factory to produce resins, also warehouse and office. Estimated cost \$5,500,000

Tex., El Paso—Standard Oil Co. of Texas, Womble Blvd., plans to construct a plant for production of heating oils, gasoline and diesel fuels. Estimated cost \$10,264,000

Tex., Houston—Shell Oil Co., Shell Bldg., plans to construct a 2nd benzene plant in Deer Park Industrial zone. Estimated cost \$12,330,000

Tex., San Antonio—W. H. Olmstead and C. B. Fulton, 645 Grandview St., plan to construct an aviation gasoline refinery. Estimated cost \$8,801,000

Wyo., Green River—Westvaco Chemical Div. of Food Machinery & Chemical Corp., Fisher Bldg., Detroit, Mich., plans to construct Trona Project to process trona into soda ash. John D. Anderson c/o owner, Engr. Estimated cost \$15,000,000

Contracts Awarded

Calif., Los Angeles—Merle Norman Cosmetics, Inc., 2527 Main St., has awarded the contract for a cosmetics plant to Myers Bros., 3407 San Fernando Rd. Estimated cost \$360,000

Calif., Maywood—General Refractories of Philadelphia, 3201 Fruitland Ave., has awarded the contract for a plant here to The Austin Co., 777 East Washington St., Los Angeles. Estimated cost \$1,000,000

Idaho, Pocatello—Westvaco Chemical Div. of Food Machinery & Chemical Corp., Fisher Bldg., Detroit, Mich., has awarded the contract for the fourth electric furnace unit for manufacture of elemental phosphorous to Bechtel Corp., 220 Bush St., San Francisco. Estimated cost \$4,500,000

	Current Projects		Cumulative 1951	
	Proposed Work	Contracts	Proposed Work	Contracts
New England.....	\$500,000	\$500,000	\$4,565,000	\$4,565,000
Middle Atlantic.....	1,225,000	1,225,000	82,288,000	82,288,000
South.....	34,000,000	12,000,000	110,811,000	208,435,000
Middle West.....	7,400,000	8,382,000	66,408,000	89,101,000
West of Mississippi.....	46,300,000	35,018,000	195,062,000	205,535,000
Far West.....	5,800,000	5,800,000	33,096,000	29,114,000
Canada.....	12,946,000	46,000,000	135,512,000	91,336,000
Total.....	\$108,241,000	\$108,905,000	\$549,089,000	\$770,372,000

Ill., Morton Grove—Baxter Laboratories, 6301 Lincoln St., have awarded the contract for a plant addition to Frevo-Smedberg Co., 5807 West Chicago Ave., Chicago. Estimated cost \$200,000

Ind., Indianapolis—Success Plastics Co., 1031 South White River Pkwy., Haughville, (Indianapolis), will rebuild part of its plant recently destroyed by fire. Work will be done by owners. Estimated cost will exceed \$100,000

Kan., Kansas City—Mineral Products Co., Pittsburg, has awarded the contract for a sintering plant for manufacture of new light weight block aggregate on Highway 32 to Quaker Valley Constructors, Pittsburg. Estimated cost will exceed \$500,000

La., Lake Charles—Continental Oil Co., Baton Rouge, has awarded the contract for expansion of oil refinery to E. B. Badger & Sons, 75 Pitts St., Boston, Mass. Estimated cost \$7,500,000

La., Shreveport—Atlas Process Co., c/o Hudson Engineering Co., 2711 Danville St., Houston and Texas & Procon, Inc., c/o Universal Oil Products Co., 3105 South Michigan St., Chicago, Ill., contractors, will construct a plant addition. Estimated cost \$3,300,000

Mass., Everett—Esso Standard Oil Co. (affiliate of Standard Oil Co. of New Jersey), has awarded the contract for modernization and expansion of refinery here to Foster-Wheeler Corp., 165 Bway, New York. Estimated cost \$500,000

Mich., Midland—Dow Chemical Co., Midland, has awarded the contract for a plant for the production of vinyltoluene to Stone & Webster Engineering Corp., 49 Federal St., Boston, Mass. Estimated cost \$8,000,000

Mo., Kansas City—Seidlitz Paint & Varnish Co., 18th and Garfield Sts., has awarded the contract for a 2 story, 26,000 ft. plant addition to Winn-Senter Construction Co., Ry. Exchange Bldg., Kansas City

Mo., St. Louis—Great Lakes Carbon Corp., 526 East Catalan St., has awarded the contract for Merchant Coke Plant addition, including installation of 40 additional coke ovens, to Fruin-Colson Contracting Co., 1706 Oliver St. Estimated cost \$2,800,000

N. C., Salisbury—Oscar Heineman Corp. c/o C. M. Guest & Sons, Greensboro, contractors, will construct a nylon throwing plant. Estimated cost will exceed \$100,000

Pa., Conshohocken—Lee Tire & Rubber Co., Spring Mill, has awarded the contract for rebuilding plasticator building recently destroyed by fire to Earl R. Kutz, Crooked Lane and King Manor, Norristown. Estimated cost \$150,000

Pa., Harmarville—Gulf Oil Corp., Gulf Bldg., Pittsburgh, has awarded the contract for a chemistry laboratory to Geo. M. Seamon Co., 5145 Liberty Ave., Pittsburgh. Estimated cost \$800,000

Pa., Philadelphia—Barrett Div. of Allied Chemical & Dye Corp., Margaret and Bermuda Sts., has awarded the contract for two warehouses to Northeast Constructors, Craig and Stanwood Sts. Estimated cost will exceed \$200,000

Pa., Washington—Tygart Valley Glass Co., Washington, will construct a warehouse with own forces. Estimated cost \$85,000

S. C., Charleston—Hewitt Oil Co., Meeting St. Rd., has awarded the contract for bulk oil tank units for storage on Cooper River to Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Estimated cost \$500,000

S. C., Pelzer—Textron, Inc., c/o Daniel Construction Co., 429 Main St., Greenville, will construct a new rayon weaving mill. Estimated cost will exceed \$500,000

Tex., Evadale—Scott Paper Co., Chester, Pa. and Houston Oil Petroleum Bldg., Houston, will construct a paper mill here. Work will be done with own forces. Estimated cost \$30,000,000

Tex., Houston—Ethyl Corp., City Natl. Bank Bldg., has awarded the contract for a control laboratory to Freiz Construction Co., 2000 Eastwood St. Estimated cost \$250,000

Tex., Houston—Southern Alkali Corp., Rusk Bldg., has awarded the contract for remodeling existing plant and constructing new plant to Telleson Construction Co., 1710 Telephone Rd. Estimated cost \$1,000,000

Tex., Trinity—Trinity Clay Products Co., Republic Bank Bldg., Dallas, will construct a clay products plant with own forces. Estimated cost \$218,000

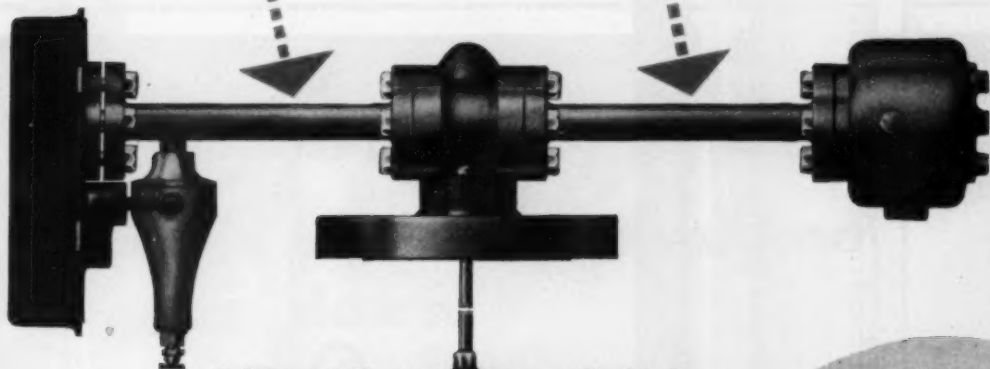
W. Va., Vienna—Libby-Owens-Ford Glass Co., Nicholas Bldg., Toledo, O., will construct a 1-story warehouse. Work will be done by separate contracts. Estimated cost \$100,000

Wis., Menasha—Central Paper Co., Menasha, has awarded the contract for 2-story 93x95 ft. factory addition to Fluor Bros. Construction Co., 48 Otter St., Oshkosh.

Alta., Edmonton—Canadian Chemical Co., Ltd., c/o Celanese Corp. of America, 180 Madison Ave., New York, N. Y., has awarded the contract for a chemical plant to Brown & Root, Ltd., 4100 Clinton Dr., Houston, Tex., USA. Estimated cost \$46,000,000

EXCLUSIVE

DUAL TORQUE TUBE



**Add a Pilot or Switch—
Get Double Duty with the**

BS&B
"Climax"

LIQUID LEVEL CONTROL!

• The revolutionary new housing design of the BS&B "Climax" Type 888 Liquid Level Controls permits the use of two torque tubes with appropriate pilots or switches. One controller can operate two pilots (direct and reverse, if desired) or a pilot and a magnetic switch. Or additional electric circuits can be controlled through the use of pressure switch set in output line of pilot.

Safety alarm controllers may sound alarm gongs or klaxons, start or stop pumps, open or close colored position light circuits.

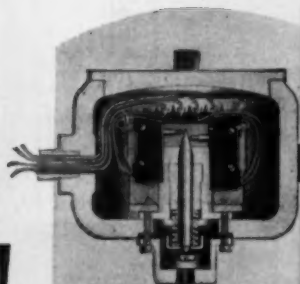
Investigate these "extras" today. Write for new, complete catalog Section 103 on the Type 888, the new liquid level controller with more than 12 years' development behind it.

BLACK, SIVALLS & BRYSON, INC.
Climax Controls Division
7502 East 12th Street, Adv. Dept., Room 52H
Kansas City 3, Missouri

BS&B

"Climax"

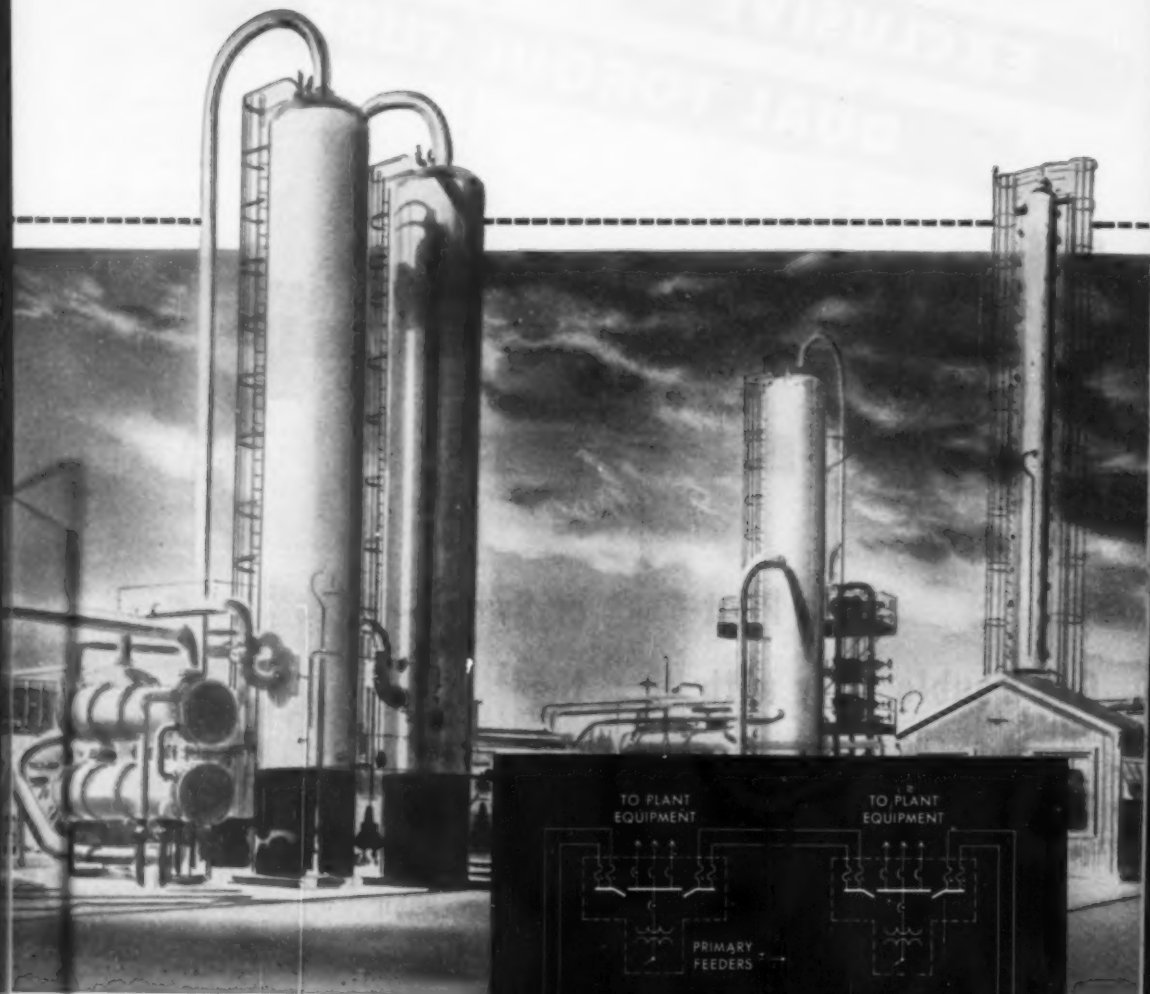
**DISPLACEMENT LIQUID LEVEL CONTROL
and SWITCHES**



Type 2112 Explosion Proof Pressure Switch, designed to operate as many as three circuits from any pressure source with as much as five pounds range. Unique diaphragm-operated design gives longer, trouble-free life. Gas-tight. Easily wired and mounted.



Type 2122 Magnetic Switch utilizes the turning movement of the Type 888 torque tube to actuate switches. Sensitive to a minimum change of 10% of the length of the displacement element. Explosion-proof cover. Mounts easily on any BS&B "Climax" liquid level control.

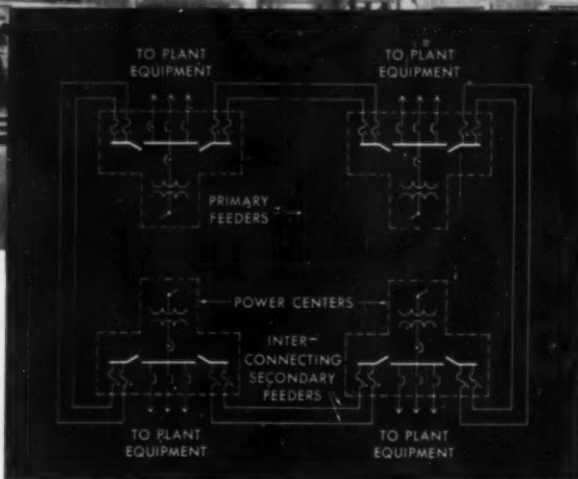


PRIMARY SELECTIVE NETWORK SYSTEM

This system rates high on service continuity and flexibility. Two Primary Feeders supply power. If a fault occurs on one, the other Feeder takes over to keep service continuous. If a fault occurs in a Power Center, its section of the plant is supplied by the adjacent Power Centers through the interconnecting Secondary Feeders.

When additional power is needed, one Primary Feeder supplies the plant while a new Power Center is connected to the dead feeder. The plant keeps operating.

This is one of eleven basic systems, all with varying characteristics. Let experienced Westinghouse engineers help you plan the system best fitted to your operations.



Westinghouse

**EQUIPMENT FOR THE
CHEMICAL INDUSTRY**



YOU CAN BE **SURE**.. IF IT'S
Westinghouse

HOW MUCH DOES IT COST **when a distilling column** **goes "down"?**

Probably more than you care to think about. But when power failure is at fault this costly threat can be eliminated. The answer:

A planned power distribution system!

When you modernize existing plants or build new ones, plan a system that *insures* service continuity . . . that gives you *alternate* power routes when electrical troubles occur. Moreover, make sure the system will be flexible . . . to permit load shifts and allow expansion without shutdown.

The Primary Selective Network shown on the opposite page is an example of a system that gives you this important service con-

tinuity and flexibility. But this is just one of the many systems you'll want to consider. Each has specific advantages depending on your particular operation. And Westinghouse can help you and your plant contractor design the system that *best* fits your requirements.

To help you make preliminary decisions we've prepared informative material covering all systems. Write for yours now. And remember, when you're building or modernizing, call in your Westinghouse engineers. With wide experience in power problems they can help you plan the one best system for your particular operation.

J-94856

HERE'S REAL HELP FOR YOUR SYSTEM PLANNING

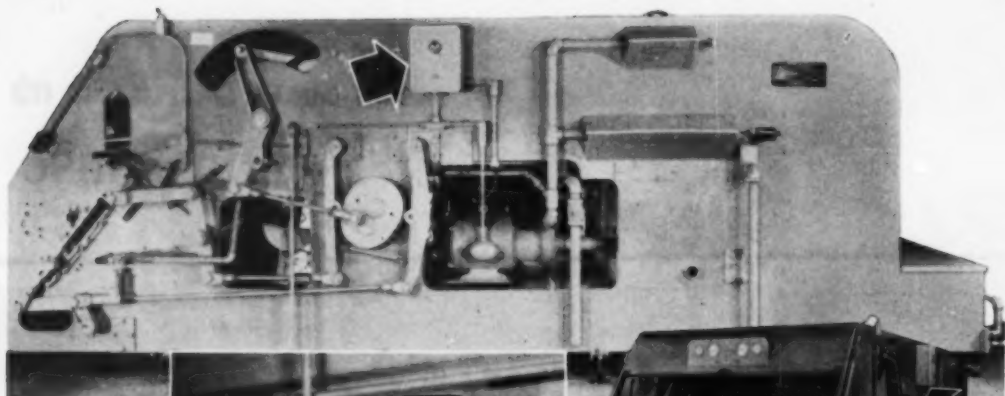


"Industrial Plant Distribution Systems": 34 fact-filled pages completely explain the eleven basic systems. Ask for B-4045.

A System Selector: pocket-sized selector card quickly shows the characteristics of each type.

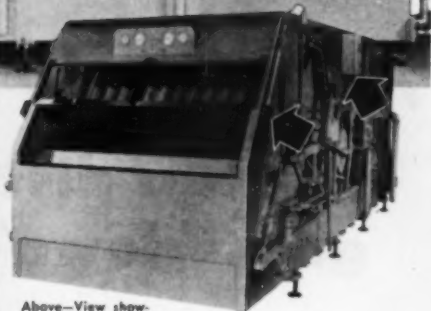
A Full-Color Movie: sound movie dramatizes the economies of system planning. Ask your Westinghouse representative for a free showing.

Get this valuable information now. Call your Westinghouse office or write: Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.



Above — Cherry-Burrall bottle washer equipped with an A-B Bulletin 709, Two Motor, Automatic Starter.

Right — Close-up of the same machine showing Bulletin 802 Precision Type Limit Switch. Many styles.



Above—View showing an A-B Bulletin 800 Standard Duty Push Button.



BOTTLE WASHER uses Reliable Allen-Bradley Motor Controls

Allen-Bradley motor starters do not require regular attention; they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install Allen-Bradley starters . . . and forget them. No contact maintenance . . . Allen-Bradley silver alloy contacts never need cleaning, filing, or dressing. Dependable overload relays . . . Allen-Bradley thermal relays are dependable and remain accurate in their operation, even after long service.

In wet locations, Allen-Bradley motor starters in NEMA Type 4 watertight enclosures assure continuous, trouble free service. Bolted covers with rubber gaskets provide complete starter protection under all water and weather conditions. Since Allen-Bradley starters are trouble free—they do not require inspection—a time and moneysaving feature in starters with bolted enclosures.

The Allen-Bradley trademark is your assurance of "quality" motor controls. Send for the Allen-Bradley Handy Catalog, today.

Allen-Bradley Co., 1337 S. First St., Milwaukee 4, Wisconsin.



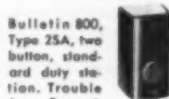
Bulletin 709 Solenoid Starter. Accurate overload protection.



Bulletin 709 Solenoid Starter in a NEMA Type 4 Watertight Enclosure.

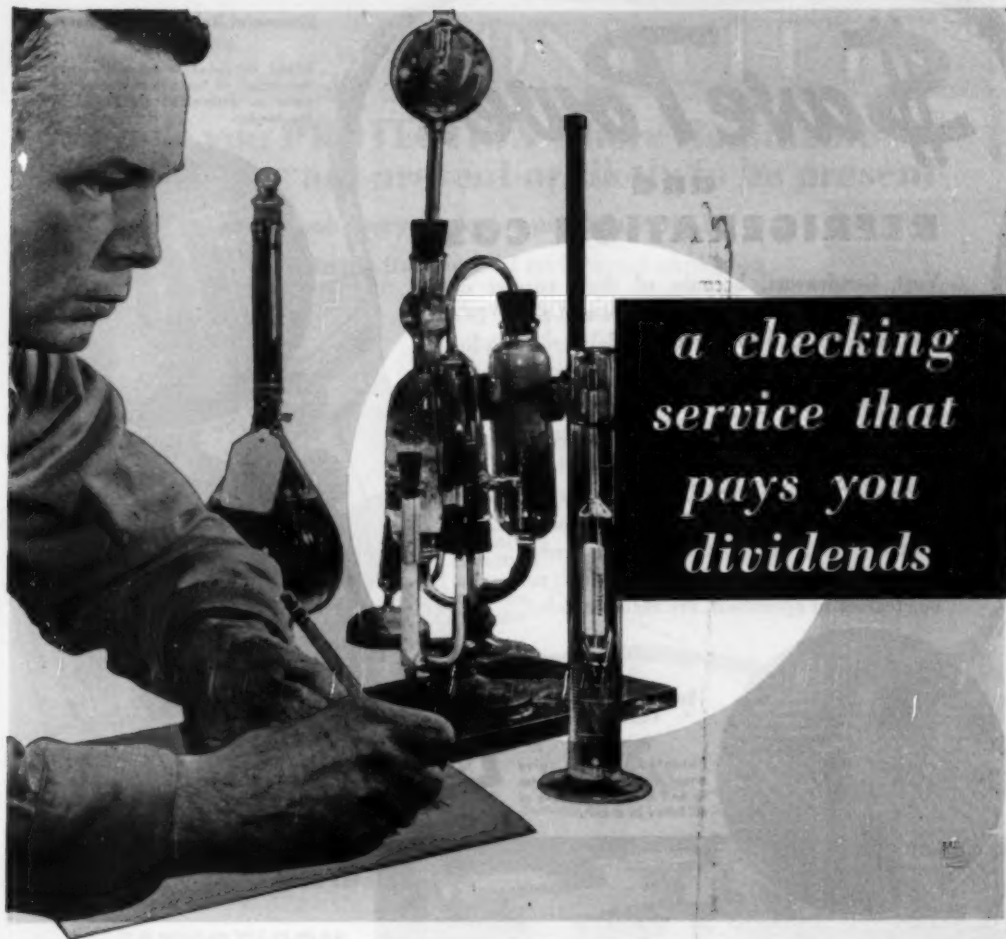


Bulletin 802 Precision Type Limit Switch. Single pole, double throw type. Compact.



Bulletin 800, Type 25A, two button, standard duty station. Trouble free. Rugged.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY



*a checking
service that
pays you
dividends*

Continuous laboratory control during the manufacture of Roosevelt's aliphatic naphtha solvents pays you dividends in *better products . . . in satisfied customers*. Why? Because this important part of the complete Roosevelt refining process guarantees that the naphthas you buy will always meet your specifications. Roosevelt gives you another important dividend, too! It is *complete* catalytic, sulphur removal. That means chemically stable solvents, free of offensive odors. Submit your solvent specifications to Roosevelt, today!



Write for your copy of
Roosevelt's book of specifications.



ROOSEVELT
oil and refining corp.

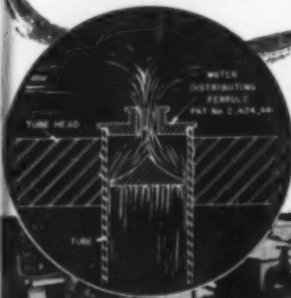
\$ave Power

and

REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.



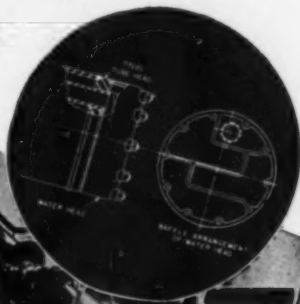
Vertical Single Pass Condensers (Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.

Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

Horizontal Multipass Condensers (Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.



375 tons capacity Multi-pass Condenser installation of Railways Ice Co., Salen, New Mexico.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

HENRY VOGT MACHINE COMPANY

INCORPORATED

1900 W. ORMSBY ST., LOUISVILLE 18, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS,
PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

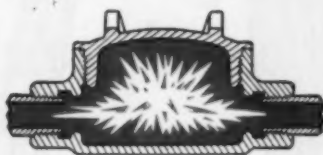
Vogt REFRIGERATION CONDENSERS

Explosion-Proof CONDULETS*

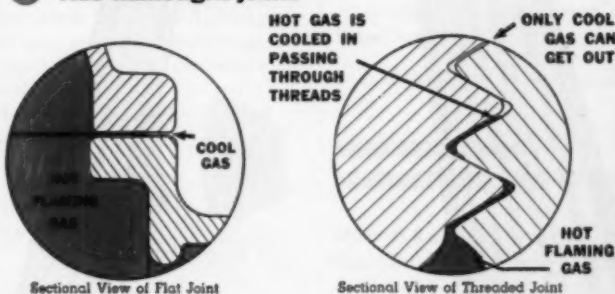
give you **PROTECTION** where flammable atmospheres are present or likely to be present

... because every explosion-proof CONDULET ...

- ① Withstands the force of an internal explosion



- ② Has flamtight joints



- ③ Operates at a safe temperature

LARGE RADIATING SURFACE



All Crouse-Hinds explosion-proof electrical equipment is built to exceed Underwriters' Laboratories requirements. Thousands of explosion-proof and dust-tight CONDULETS are listed in Crouse-Hinds CONDULET Catalog.

A
Nationwide
Distribution
Through Electrical
Wholesalers

CROUSE-HINDS COMPANY
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Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington, D.C. — Youngstown — Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va.
CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

**CONDULETS
are made only by
CROUSE-HINDS*

CONDULETS • TRAFFIC SIGNALS • AIRPORT LIGHTING • FLOODLIGHTS

Sure

Stainless Pipe



1139 Ft.
2 in.
Schedule 5

500 Ft.
2 in.
Schedule 40

is Tough to Get...

but using light weight **Schedule 5 Pipe**
will almost double the supply
—and you pay less per foot!

What Schedule 5 Pipe Is—

A light wall pipe, Carpenter *Schedule 5* gives you more feet of pipe for every pound of scarce stainless steel. So you can quickly see how *Schedule 5* increases the amount of pipe available and reduces your cost per foot. Plus the fact that the larger I.D. means increased flow area. These cut-away sections of pipe show the actual difference in wall thickness.



How Schedule 5 Reduces Costs

First saving is 40% to 50% on the cost of your pipe. And, because *Schedule 5* lets you use the next smaller pipe size, you reduce by as much as 25% your costs of valves, fittings, etc. Carpenter *Schedule 5* Pipe often permits the use of the next smaller pipe size, because of its larger inside diameter.

How It Hooks Up With Tube

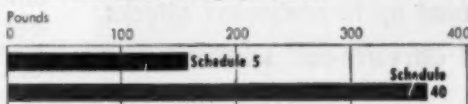
This pipe is easily adapted to use with existing lines of tubing or *Schedule 40* and *10* pipe, using simple connectors available from several manufacturers.

Why It Means More Pipe

You get *more feet of pipe* for every pound of material with Carpenter *Schedule 5* Stainless Pipe. And

we don't have to tell you how important it is to get *more steel* from every pound of nickel and chrome these days.

2" I.P.S. STAINLESS PIPE weight per 100 feet



How It Resists Corrosion

You get the full corrosion resistance of the stainless analysis with Carpenter *Schedule 5* Pipe. It is made in standard A.I.S.I. analyses of stainless steel.

What Pressures It Handles

All sizes of Carpenter *Schedule 5* Pipe will handle 150 psi working pressures with a good margin of safety. Sizes up to 1½" will safely handle considerably higher working pressures. Where high pressures are involved, however, *Schedule 40* may be required.

Data Sheets Give You More information about this opportunity to get more stainless pipe for essential uses. Write for a copy now. Under today's conditions, Carpenter *Schedule 5* Stainless Pipe may help solve several big problems, including "When can I get the pipe I need?"



THE CARPENTER STEEL COMPANY
Alloy Tube Division, Union, N. J.

Export Department: Carpenter Steel Co., Reading, Pa., "CARSTEELCO"

Carpenter

STAINLESS TUBING & PIPE



—guaranteed on every shipment

How 3 potash refineries beat corrosion problems with standard G-E motors

Totally enclosed and cast-iron, TRI/CLAD motors stand up to continuous attacks of corrosive-salt solutions

These three potash refineries in the Carlsbad, New Mexico, area rely extensively on standard General Electric totally enclosed fan-cooled Tri-Clad* motors. Strong on corrosion defense, these motors can be located wherever convenient for driving machinery, space economy, maintenance accessibility. And because they're of standard design, initial cost is lower, shipment faster. For more information, write for Bulletin GEA-4131. General Electric Company, Schenectady 5, N. Y.



AT U.S. POTASH COMPANY



▲ Cast-iron enclosures on Tri-Clad totally enclosed motors are high in corrosion resistance. That's one reason why these motors are ideal for chemical-plant jobs like this, in which a 40-hp, 1200-rpm unit drives a dissolver agitator.

◀ Driving brine pumps in the refinery, these Tri-Clad motors are rated 30 hp, 440 volts, 1800 rpm. U. S. Potash Company uses dissolvers to separate sodium chloride from potassium chloride in processing the potash salts.

* Registered trademark of General Electric Co.

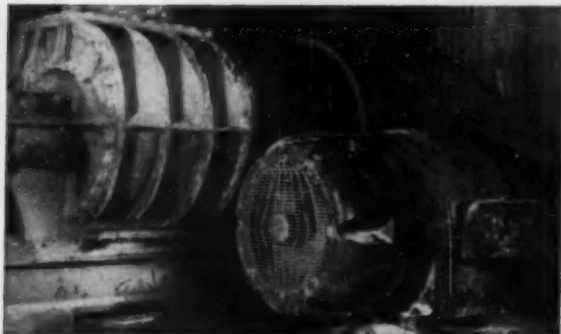
GENERAL



ELECTRIC

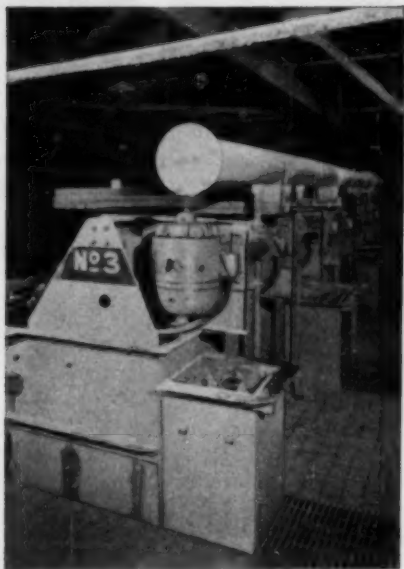
662-36

AT POTASH COMPANY OF AMERICA

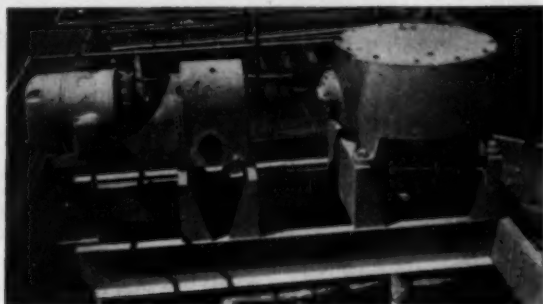


↑ Precision-machined joints assure tight fits to prevent entry of moisture and brine, and bearings are protected against dust as well as corrosion. This Tri-Clad totally enclosed motor—rated 150 hp, 900 rpm—drives the blower for a fines exhauster in the PCA refinery.

In tough flotation-cell service—where production interruptions from motor failure → can be quite costly—Tri-Clad totally enclosed motors keep going despite occasional splashing from salt brine. This bank of twelve 5-hp, 220/440-volt, 1200-rpm units drive agitators in the refinery's flotation cells.



AT INTERNATIONAL MINERAL AND CHEMICAL CORPORATION



↑ Because of the extra protection afforded by their cast-iron double-wall frame and end shields, Tri-Clad totally enclosed motors have been popular standards for years with chemical plants. This 20-hp, 220/440-volt, 1800-rpm unit requires little or no maintenance in driving a feed-tank turboagitator in the refinery.

← Tri-Clad totally enclosed motors withstand the effects of exposure to weather as well as various chemical-plant brines. This unit—rated 100 hp, 440 volts, 1800 rpm—is located outdoors to drive a circulating pump at the main cooling tower of International Mineral and Chemical Corporation's refinery.

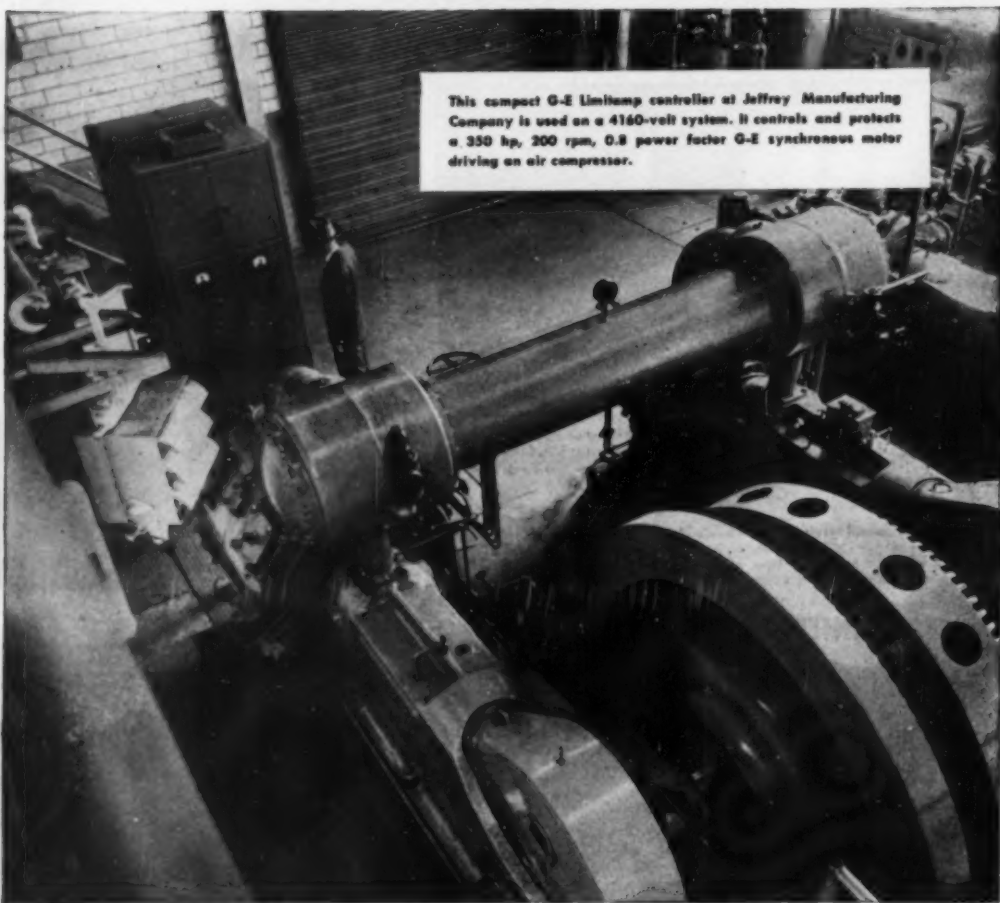


Totally enclosed fan-cooled

MOTORS
for chemical plants

Turn page for tips on Control ►

Jeffrey Manufacturing Uses G-E Limitamp Control



This high-voltage control meets a need for ample interrupting capacity, protection for operating personnel, good appearance and compactness

The addition of a large compressor for general plant use called for a synchronous motor and dependable high-interrupting-capacity control at Jeffrey's modern power house. In addition to the accurate synchronization obtained with the new field control of this air-break Limitamp controller, and the factors mentioned above, Jeffrey likes the co-ordinated design of this G-E controller that is factory engineered and built. Such a

compact, steel-enclosed controller is easily installed, requires little space—yet has all the features that provide protection for both equipment and personnel. And it's quickly inspected and maintained.

Rapid duty cycles do not affect the long life inherent in G-E Limitamp—now available in ratings up to 4800 volts with an interrupting capacity up to 250 mva. Shorts are cleared in less than half a cycle—offering positive protection for your expensive electric equipment. Write for more information on the new Limitamp controller—also available for squirrel cage and wound rotor motor control—in Bulletin GEA-5409. *General Electric Company, Schenectady 5, N. Y.*

GENERAL  ELECTRIC

730-31

HYDROCHLORIC ACID



FOSTER WHEELER FALLING FILM ABSORBER

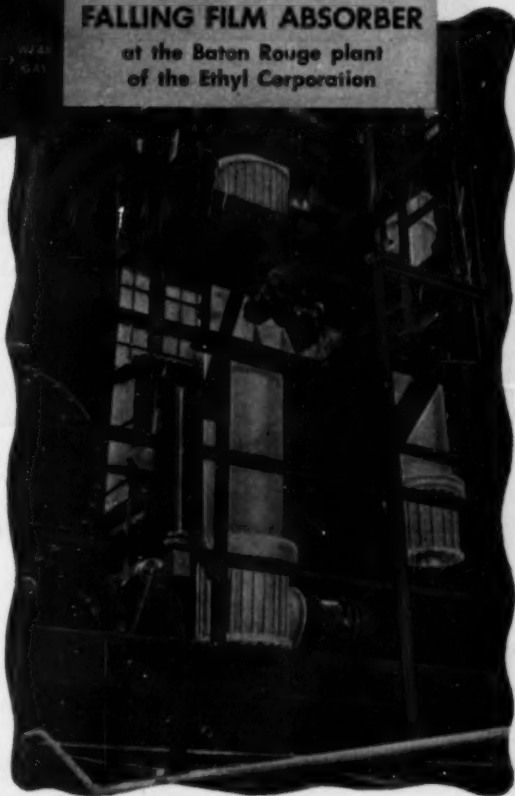
at the Baton Rouge plant
of the Ethyl Corporation

Foster Wheeler Falling Film Absorbers are proving particularly efficient for absorption of Hydrogen Chloride in weak Hydrochloric Acid.

Absorption takes place on the inside surfaces of corrosion resistant "Karbate" tubes in a cooler absorber. Since "Karbate" impervious graphite has a thermal conductivity three times that of steel the heat of absorption is efficiently transferred to cooling water. Unabsorbed HCL is scrubbed with water or dilute acid in a tails tower which feeds liquid to the cooler absorber.

For some time, four 60-tube units have been in service at the Ethyl Corporation at Baton Rouge, Louisiana. These absorbers boost 21% acid to 33% concentration for the manufacture of anhydrous HCL required in production of Tetra Ethyl Lead.

For further information, write to:
FOSTER WHEELER CORPORATION
165 BROADWAY NEW YORK 6, N. Y.



FOSTER WHEELER

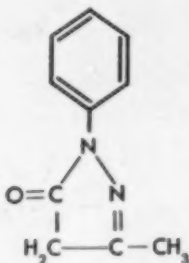
Leading engineers and builders of industrial processing equipment, chemical plants, heat exchangers, steam generators, and oil refineries.

DOW

one of many chemicals
serving the Pharmaceutical Industry

3-Methyl-1-Phenyl-5-Pyrazolone

Used in the preparation of pharmaceuticals and as a dye intermediate.



PROPERTIES

White to slightly yellow powder

Boiling point at 17 mm. Hg.....191°C.

Melting point.....128.9°C.

Molecular weight.....174.2

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

Send for Experimental Sample

The Dow Chemical Company
Dept. PC-2
Midland, Michigan

Please send me an experimental sample of 3-Methyl-1-Phenyl-5-Pyrazolone.

Name _____ Title _____

Company _____

Street _____

City _____ State _____

DOW

CHEMICALS

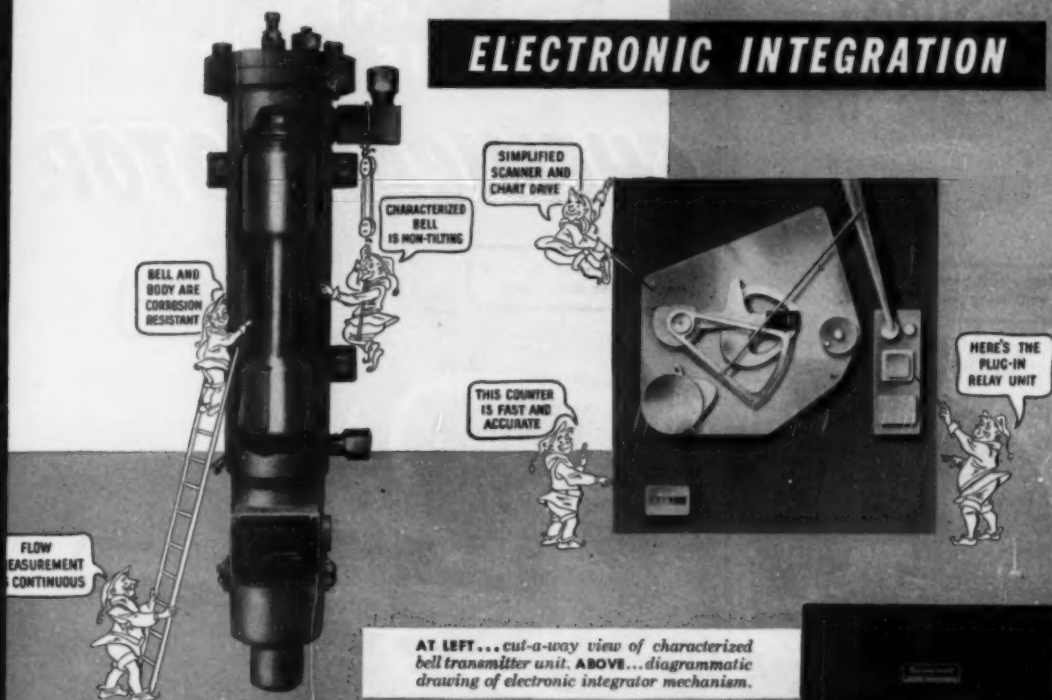
INDISPENSABLE TO INDUSTRY
AND AGRICULTURE

Important Contribution to Flow Measurement and Accounting

The New

Brown Electric Flow Meter incorporates . . .

ELECTRONIC INTEGRATION



HERE's another important advancement for power and process instrumentation...continuous flow measurement, with electronic integration!

This Honeywell development eliminates intermittent measurement and slow, complicated totalizing...welcome news to process engineers and accountants.

The electronic integrator, consisting of but three major parts, simplifies accessibility and maintenance . . . permits quick checking and calibration. Scanning is rapid and extremely simple. The corrosion resistant meter body is of tubular construction, reducing weight

and bulk. Electrical transmission permits remote, continuous recording of flow...and flow is easily totalized under all conditions. The characterized bell is corrosion resistant, too, and is specially designed to eliminate tilting.

Call in our local engineering representative for a discussion of your application.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, 4478 Wayne Ave., Philadelphia 44, Pa.



EVERLY-DIVIDED CHART... provides easy readability for all rates of flow. Write for new Bulletin No. 293-1.

MINNEAPOLIS Honeywell

Brown Instruments

For Maximum
Resistance to
Corrosion
Be Sure
to Specify..

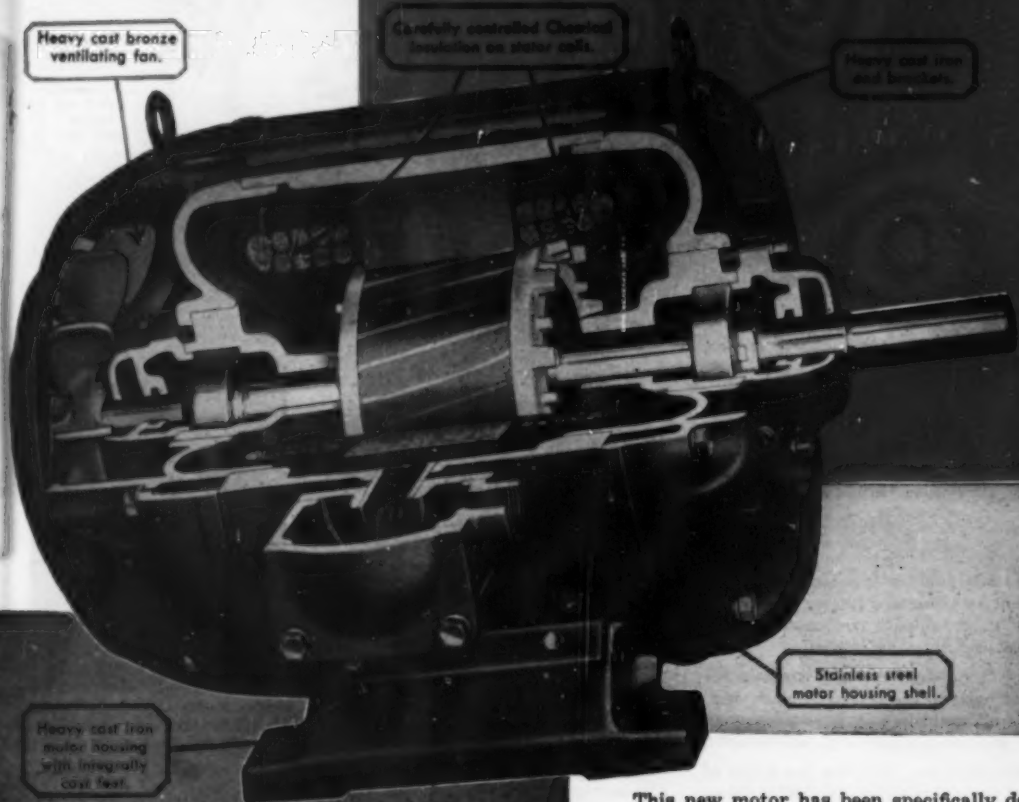


THE LOUIS ALLIS *CHEMICAL MOTOR*

Heavy cast bronze
ventilating fan.

Carefully controlled chemical
insulation on stator coils.

Heavy cast iron
and bronzes.



Heavy cast iron
motor housing
with integrally
cast feet.

Stainless steel
motor housing shell.

THE LOUIS ALLIS CO.

MILWAUKEE

WISCONSIN

50
YEAR
1901-1951

This new motor has been specifically designed and constructed to withstand the corrosive conditions encountered in chemical plants, oil refineries, and other similar operating conditions.

For further information contact your nearest
LOUIS ALLIS Sales Engineer.

LET'S TALK over the PRESSURE VESSELS you're planning



Before you decide who's going to build your next pressure vessels, call in a Bethlehem engineer and learn exactly what he can offer.

He'll explain, among other things, how Bethlehem's facilities for building forged vessels are unsurpassed anywhere in the country. He'll tell you about the advantages of Bethlehem's complete service, which includes everything from the making of the carbon or alloy steel to the testing of the finished units.

Bethlehem-built vessels are made in any size or type

required and with any desired thickness of wall. They are forged, treated, and machined in our own shops by men who have devoted years to these specialties. They are subject to exhaustive metallurgical checks by staff technicians.

Whether the vessels you plan are single or multiple units . . . whether they're small, medium, or giant-size . . . you can rely upon Bethlehem for a good, sound job. We're proud of the fact that we do expert work and that our customers keep coming back to us.

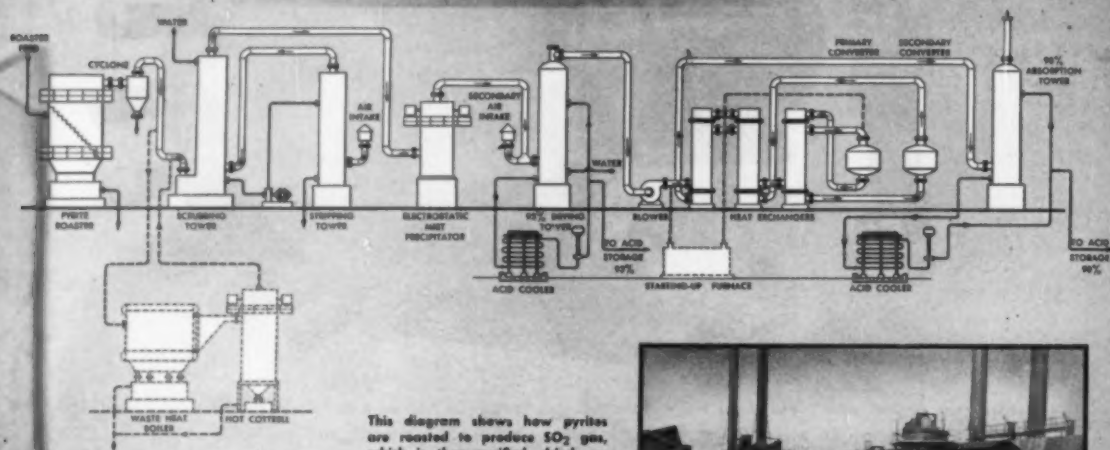


BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Another
practical
solution
to the
sulfur
shortage

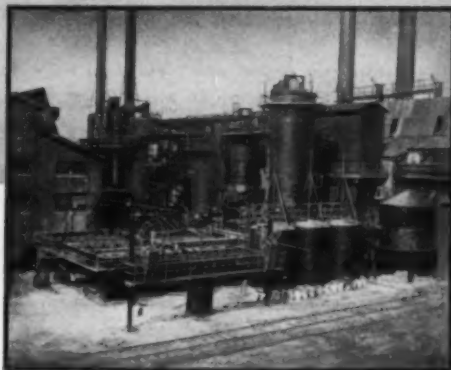
Make Sulfuric Acid from **PYRITES**



This diagram shows how pyrites are roasted to produce SO_2 gas, which is then purified, dried, re-heated and converted into H_2SO_4 of any desired strength.

HERE's a practical answer to the sulfur shortage. With the Chemico acid process diagramed above, vitally needed sulfuric acid can be manufactured from ores such as pyrite, pyrrhotite and other metal sulfides which are in plentiful supply. The Chemico acid process can be adapted to use the sulfur dioxide gas from any preferred standard type of roaster.

Our wide experience in the design and construction of acid-making facilities enables us to deliver efficient plants on a performance-guaranteed basis.



For additional information
on this Chemico process write for
Bulletin S-102

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE: CYANAMID PRODUCTS, LTD., LONDON W. C. 2, ENGLAND

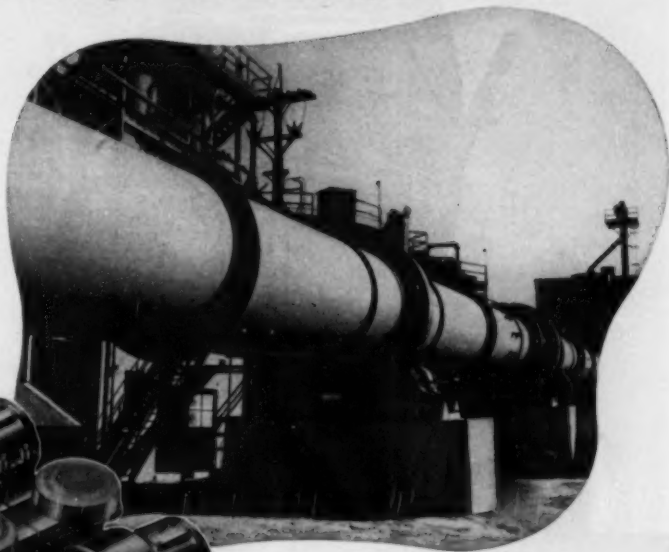
CABLE: CHEMCONIST, NEW YORK



Chemico plants are
profitable investments

"Everything considered..."
means lower thermo-processing costs
with a Traylor Rotary Kiln

Roller supports are important to economical Rotary Kiln operation. Traylor supports are quickly adjustable to maintain perfect shell alignment for trouble-free, low-cost thermo-processing. Traylor offers several types of roller supports... recommends the type best suited for each installation.



Everything... even the most minor detail... is carefully considered before Traylor builds a Rotary Kiln. 40 years of experience has demonstrated to Traylor that the smallest details... as well as the more obvious factors... play an important part in every efficient Rotary Kiln installation. Place your thermo-processing problem in Traylor's hands where "everything considered" means lower costs for you.

Traylor

Rotary Kilns, Coolers and Dryers • Grinding Mills
Jaw, Reduction and Gyratory Crushers • Crushing Rolls



MAIL THIS COUPON
FOR FREE TRAYLOR KILN BOOKLET

TRAYLOR ENGINEERING & MANUFACTURING CO.
363 MILL ST., ALLENTOWN, PA.

Send me your latest booklet on the operating advantages of Traylor Rotary Kilns.

Name _____

Company _____

Address _____

SALES OFFICES: New York, N.Y.; Chicago, Ill.; Los Angeles, Calif.
Canadian Mills: Canadian Vickers, Ltd., Montreal, P.Q.

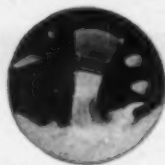
A "TRAYLOR" LEADS TO GREATER PROFITS



STURTEVANT DUSTLESS BLENDERS

**Thoroughly Blend Substances
into an Inseparable Mass**

The 4-Way Mixing Action of the Sturtevant Dustless Blenders thoroughly mixes two or more substances into an inseparable whole . . . every part of which is the same analysis. Single receiving and discharging opening insures tight sealing during mixing process. "Open-door" accessibility permits thorough cleaning. The fast, accurate mixing operation increases output . . . cuts mixing costs. Available in many sizes with mixing capacities from $\frac{1}{4}$ ton to 75 tons per hour. Write for information and catalog.



Receiving — The ingredients to be mixed enter the mixing chamber of drums through a chute. Note scoops which carry up and dump the ingredients as drum rotates assuring a more uniform mix.



Discharging — Throwing a lever closes the inlet and mixer is in discharging position. The completely mixed materials drop off through chute without segregation of ingredients.

The Sturtevant Mill Company

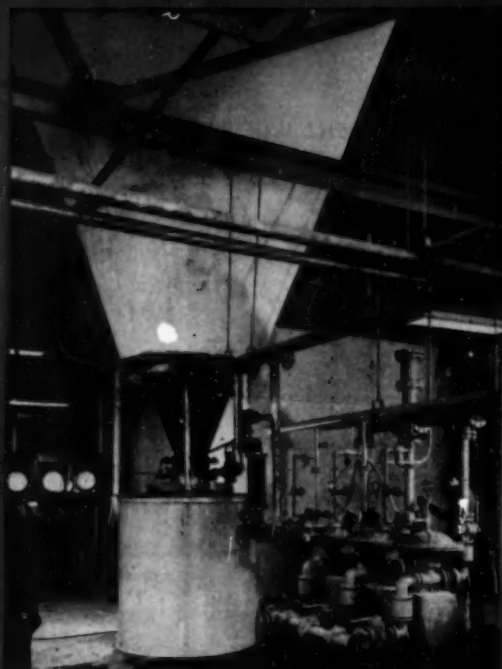
100 Clayton Street, Boston 22, Massachusetts

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

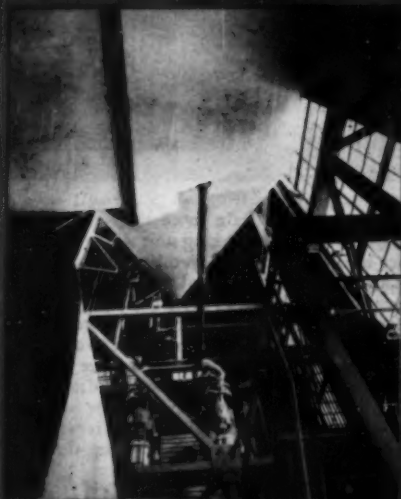
WORLD'S LARGEST CAPACITY SPRAY DRYER*

produces Micro-Sphere Catalyst

*Swenson-Designed
Swenson-Fabricated
Erected under Swenson
Supervision
Placed Onstream by
Swenson Engineers*

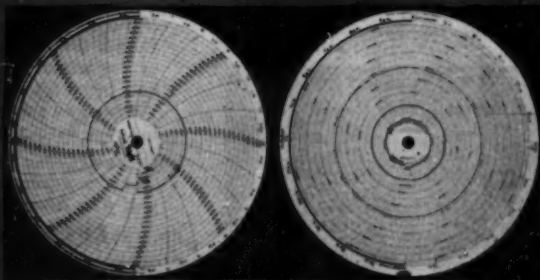


LOWER SECTION, DRYING CHAMBER



UPPER SECTION, DRY CHAMBER

***Over 30,000 Pounds per
Hour Evaporation**



TYPICAL BEEHIVE CHARTS

SWENSON EVAPORATOR CO. DIVISION OF WHITING CORPORATION

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**THE SAVINGS WILL PAY FOR
THE EXTRA TRAPS!**



SAVES 14 TONS COAL MONTHLY . . .
that's the profitable result of changing
over to Armstrong Traps . . . M. Wile
and Company, Buffalo, N. Y.



2-3 HOURS FASTER HEAT-UP . . . starch
drier takes new lease on life after
Armstrong Unit Trapping . . . Industrial
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Ontario



40° TEMPERATURE RISE . . . pyrometer
readings on flatwork ironer rolls
prove performance of Armstrong Unit
Trapping . . . Peter Bent Brigham
Hospital, Boston, Mass.



**You'll be
money ahead
with**

ARMSTRONG UNIT TRAPPING

DON'T DO THIS!



DO IT THIS WAY!



IT IS false economy to drain more than one coil, kettle, unit heater or other steam-consuming unit with a single trap. In the first place a single trap for several units must be larger and higher priced than the individual trap on *each* unit, so the difference in original cost is not as great as it might first appear. But the difference in performance can be *tremendous*. The slightest difference in condensing rate between two units will cause a difference in steam pressures between the units. Even a few ounces pressure difference will hamper drainage of condensate and, most important, will prevent or retard flow of air from the lower pressure unit. The result is widely varying and subnormal temperatures, less heat output, slower heat-up, less production and higher operating costs.

Don't be penny wise and pound foolish. Install a trouble-free Armstrong trap on each steam-consuming unit in your plant. Call your Armstrong Representative today.

ARMSTRONG MACHINE WORKS

858 Maple Street • Three Rivers, Michigan

SEND FOR THE STEAM TRAP BOOK —



36 pages of practical data
on selection, installation
and maintenance of traps.
Yours for the asking.



ARMSTRONG STEAM TRAPS

MODERN

Miracle Drugs

ARE MADE HERE



The Upjohn Co., Portage Road Plant, Kalamazoo, Mich.

• The Austin Company—Engineers and Builders

UPJOHN'S MAMMOTH NEW PLANT equipped for clean air by AAF!

THE COMPLETION of Upjohn's superb new plant means better health . . . more active lives for millions of Americans. Here, no expense or engineering talent was spared to obtain the most modern facilities for controlled pharmaceutical manufacturing. Since modern medicines . . . particularly anti-biotics and other sterile solutions . . . exact unusual requisites for sterility and plant hygiene even the air had to be hygienically *clean*.

American Air Filter products were selected to perform this service for the entire plant. Nine distinct types of AAF air filters and dynamic precipitators were used to supply clean air to the many operations and control the dust created by some of them. Though the problems involved both degree of air cleanliness and a wide spread in required volumes—AAF's complete line provided efficient and practical solutions in every instance.


For specific applications see the following pages . . .

American Air Filter

COMPANY, INC.

215 Central Ave., Louisville 8, Ky. • In Canada: Darling Bros., Ltd. Montreal, P. Q.





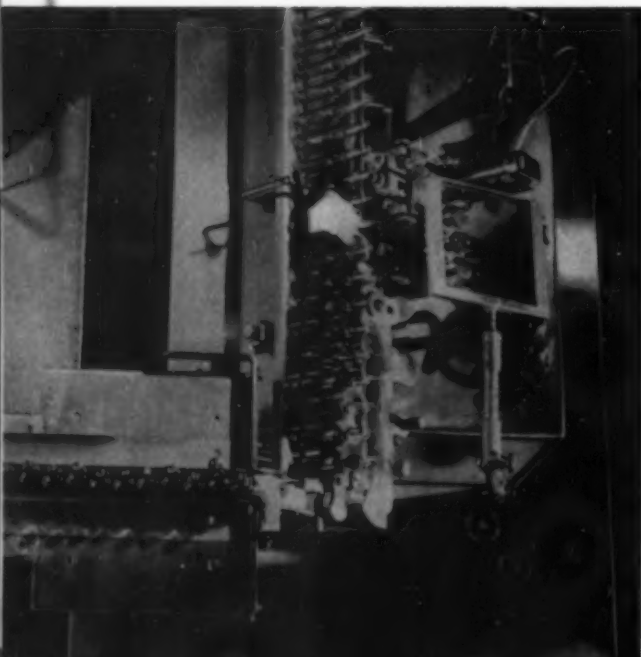
91 AAF UNITS

Supply More Than 1,000,000 c.f.m.
... of Clean Air

MODERN pharmaceutical manufacturing creates highly diversified problems of air care. These range from maintaining sterile laboratory conditions to eliminating dust in maintenance shops. Illustrated are a few operations at the new Portage Road plant serviced by several types of AAF air filtering products. Upjohn's selection was based on their many years of experience with American Air Filter equipment.

AIR HYGIENE PROBLEMS

solved by nine types of AAF products



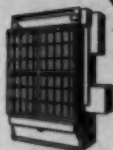
FILTER TYPES AND CAPACITIES
Upjohn Portage Road Plant

TYPE	NO. OF UNITS	TOTAL CAPACITIES cfm
AAF Electro-Matic	7	83,850
AAF Electro-Airmat	1	2,000
AAF Electro-PL	1	2,000
AAF Multi-Duty	53	830,570
AAF Multi-Panel	1	15,000
AAF Roto-Clone Type D	4	19,470
AAF Roto-Clone Type W	23	96,920
AAF Dust Box	1	1,200
TOTAL	91	1,051,010

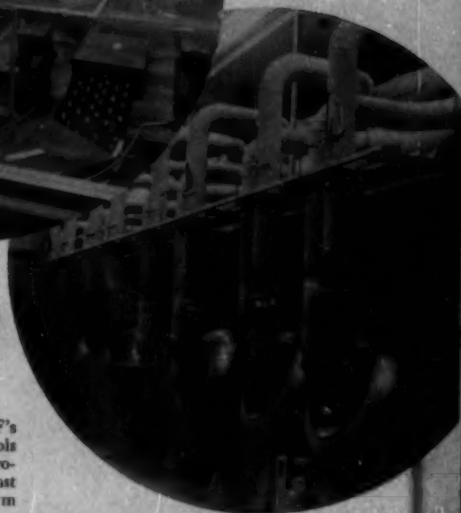
AAF's Amer-glas disposable filter is used extensively throughout the plant.



- Bacterial filtration processes require exceptionally sterile conditions. Here, AAF's Electro-Matic supplies super-clean air by highest cleaning efficiency.



- Freeze Dry Area. Another operation requiring highly sterile conditions, as seen by visitors through observation panels. Again Electro-Matics supply the super-clean air required.



Upjohn's new Portage Road plant occupies approximately 33.2 acres of floor space. Main manufacturing building is 875 feet wide and 1120 feet long.

- Coating Pan battery. AAF's Type W Roto-Clone controls this dust source. These hydrostatic precipitators collect dust and store it in sludge form within self-contained units.



Antibiotics building at far right.

- Counting and Packaging. Air for this operation is filtered by AAF's Multi-Duty. A total of fifty-three Multi-Duty units are installed at the new Portage Road plant.

- Spray Drying. AAF's PL-24 and Amer-glas filters make an efficient team to eliminate airborne particles.



- Conveyors and transfer points. American Air Filter's Type W Roto-Clones provide complete collection of finely divided material at the source.



today's best buy is better air!

THERE IS ONLY ONE COMPLETE LINE OF AIR CLEANING EQUIPMENT...AAF!

For thirty years American Air Filter has pioneered air filtration and dust control. Today its highly diversified products serve industry and commerce throughout the world.

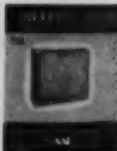
AAF's engineering research in the control of air pollution is continually developing new methods, new products and solutions to new problems. The engineering staff is recognized as having the outstanding experience available in this field. If you have a problem requiring *clean air* call your AAF representative. He will provide a practical solution.



PHARMACEUTICALS • TEXTILE MILLS • DEPARTMENT STORES • HOTELS • BANKS • TRANSPORTATION
FOUNDRIES • METAL WORKING • CHEMICALS • PAPER MILLS • INDUSTRIAL FINISHING • MINING



These are a few of many AAF Engineering Bulletins covering all phases of air cleaning and the complete line of AAF products. Bulletins will be mailed on written request.

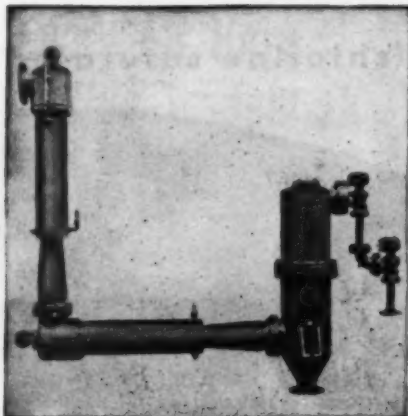


AAF

American Air Filter
COMPANY, INC.

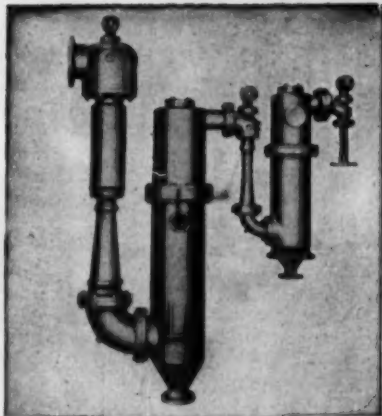
215 Central Avenue, Louisville 8, Ky.

• In Canada: Darling Brothers, Ltd., Montreal, P. Q.



HIGH VACUUM?

Four-stage Worthington condensing ejector is typical of four- and five-stage units for vacuum drying and distillation processes below 1 mm Hg abs.



INTERMEDIATE VACUUM?

Three-stage Worthington condensing unit is for intermediate vacuum applications in the range from 10 mm to 1 mm Hg abs.

WHICH PICTURE solves your vacuum problem?

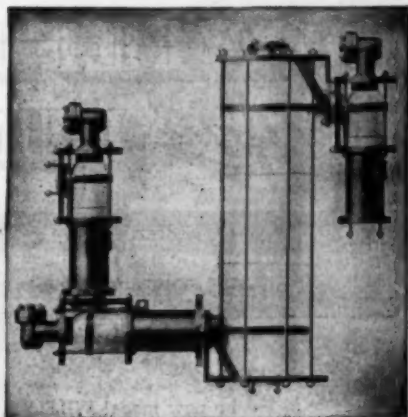
This is the *really complete* steam-jet ejector line—Worthington.

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Experience in this field reaching back to 1918 and a fund of estimating data are available to consulting engineers and end users.

For distillation, drying and other purposes, get the most out of vacuum with Worthington Steam-Jet Ejectors. *There's more worth in Worthington.* Worthington Pump and Machinery Corporation, Steam Power Division, Ejector Section, Harrison, New Jersey.



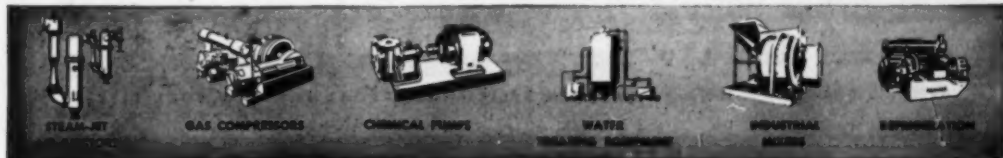
SPECIAL MATERIALS?

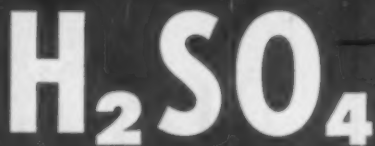
This Worthington unit is made of special acid-resisting material for handling highly corrosive vapors. Available in many anti-corrosive materials.

WORTHINGTON



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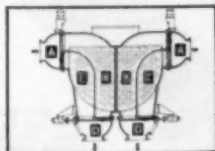
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Both halves work the same but independently of each other. Left Side: Water enters divided water box at valve chamber A, with upper port open. It flows through pass B to end of condenser, back through pass C and out through left port of D.

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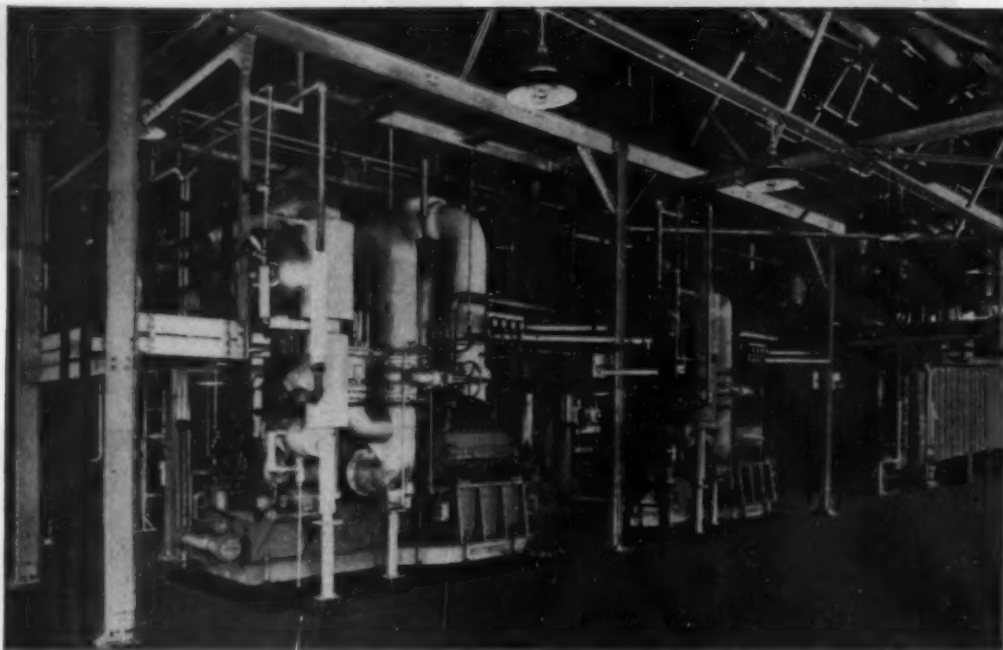
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Two Worthington centrifugal compressors, each capable of handling the full 380-ton load; at right, one of the three Worthington chilling machines.

How Socony-Vacuum Gives Wax the Cold Shoulder

For the new addition to its Paulsboro refinery, Socony-Vacuum and its process engineers and constructors, E. B. Badger & Sons Co., found the right chilling equipment in Worthington's complete line.

Here's how this modern plant meets the 380-ton refrigeration load required by its solvent dewaxing process.

Plant propane is alternately condensed and vaporized in a closed cycle. The liquid propane, boiling at a low pressure and a constant temperature of minus 25F, surrounds the tubes in the Worthington inclined chiller

through which the wax-bearing mixture is pumped.

Propane vapor, released in the chiller, is withdrawn to be compressed, with two liquid intercooling stages, from suction conditions of about 8 psig to a condenser pressure of 215 psig.

The compressors are four-stage Worthington centrifugal compressors. They are driven by 8420 rpm Worthington steam turbines which take steam from the plant mains at about 400 psig and exhaust at 40 psig back pressure to be used for heating purposes in other parts of the solvent recovery process.

Important installations such as this one are most likely to include Worthington refrigeration, because Worthington offers complete cycles for petroleum, chemical and petro-chemical applications, including centrifugal charge gas compressors for high pressure, condensers, coolers and exchangers.

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A.143

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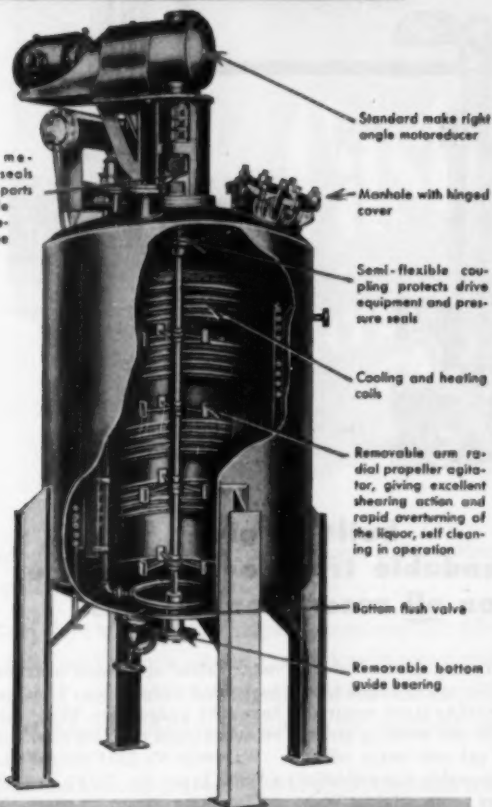
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The agitators, supporting structure, agitator shaft seals and drive incorporated in the new Struthers Wells Hydrogenator have been carefully designed to give maximum efficiency and long trouble-free service in dispersing gases and catalysts under normal or extreme conditions of temperature and pressure.

The diagrammatic illustration at the left shows how the agitator shaft is independently supported at two points within the vessel. Note how the radial propeller agitators are mounted in multiple on the shaft dividing the overturning of the content into several strata. The coils are carefully located to provide minimum obstruction to proper agitation and the flush outlet valve eliminates a pocket into which the catalyst might accumulate. This type of equipment is ordinarily made of stainless, nickel, monel, inconel or mild steel and individually designed to operate under specific conditions of pressure, vacuum, temperature and degree of agitation.

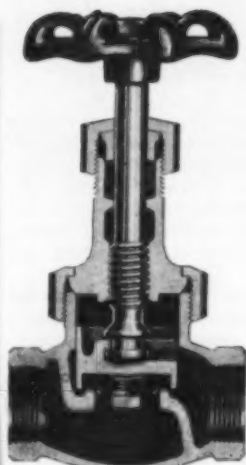
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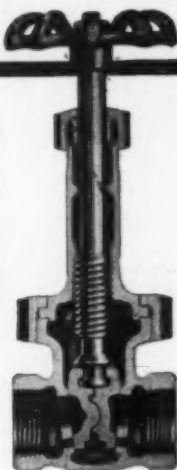
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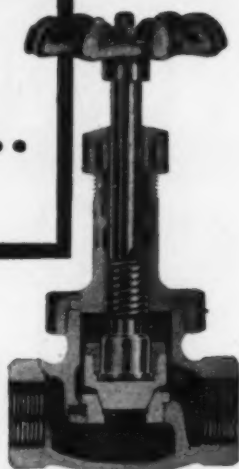
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Re-New-Disc



Walworth
No. 29 Gate Valve



Walworth No. 225P Globe Valve
300 Brinell Seat and Disc

**built to give
dependable trouble-free service
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Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development — saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bon-

nets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

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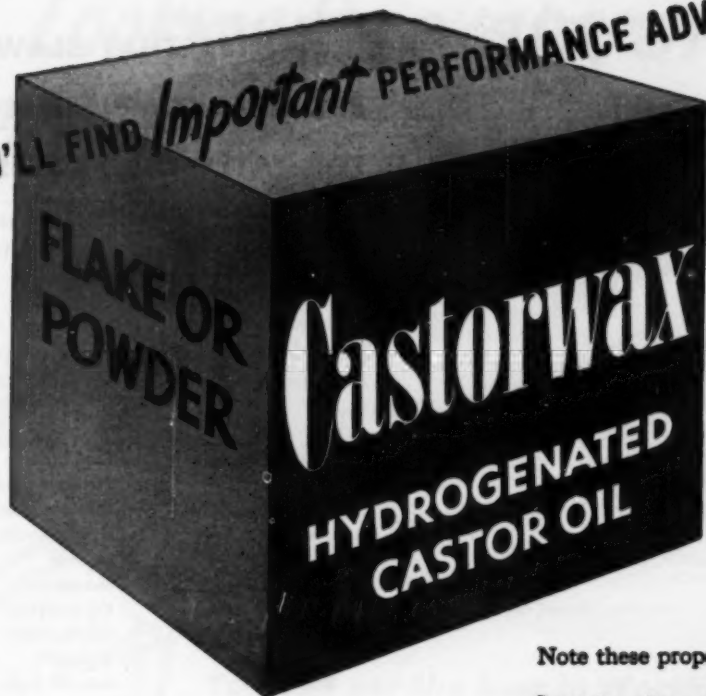
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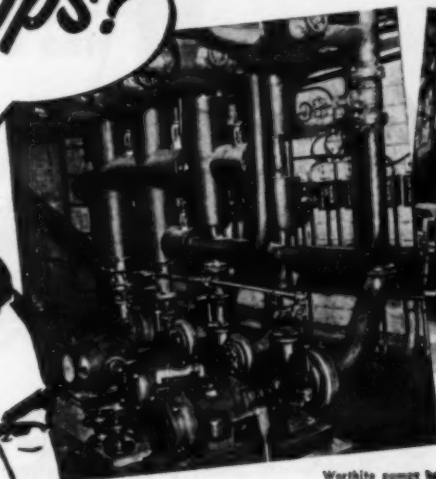
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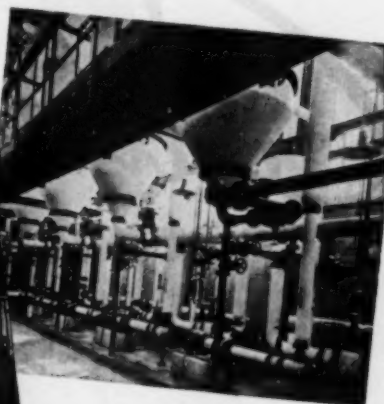
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Worthington has evolved a scientific

method of selecting exactly the right pump for size, speed, head, capacity and NPSH. Let us show you how it works. For further facts proving *there's more worth in Worthington*, call your nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

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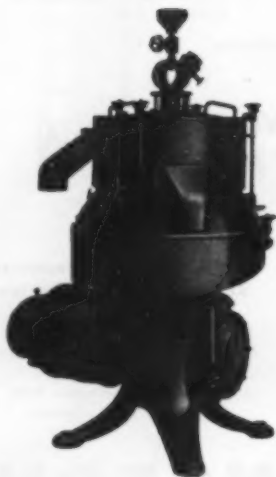
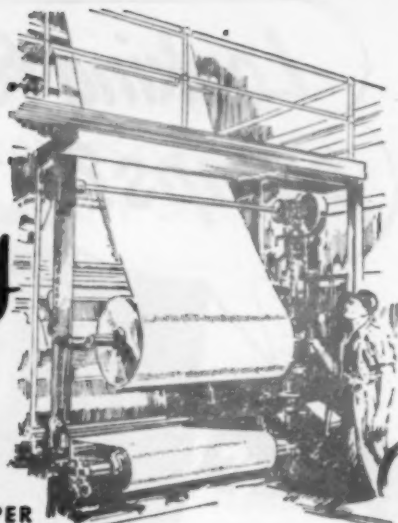


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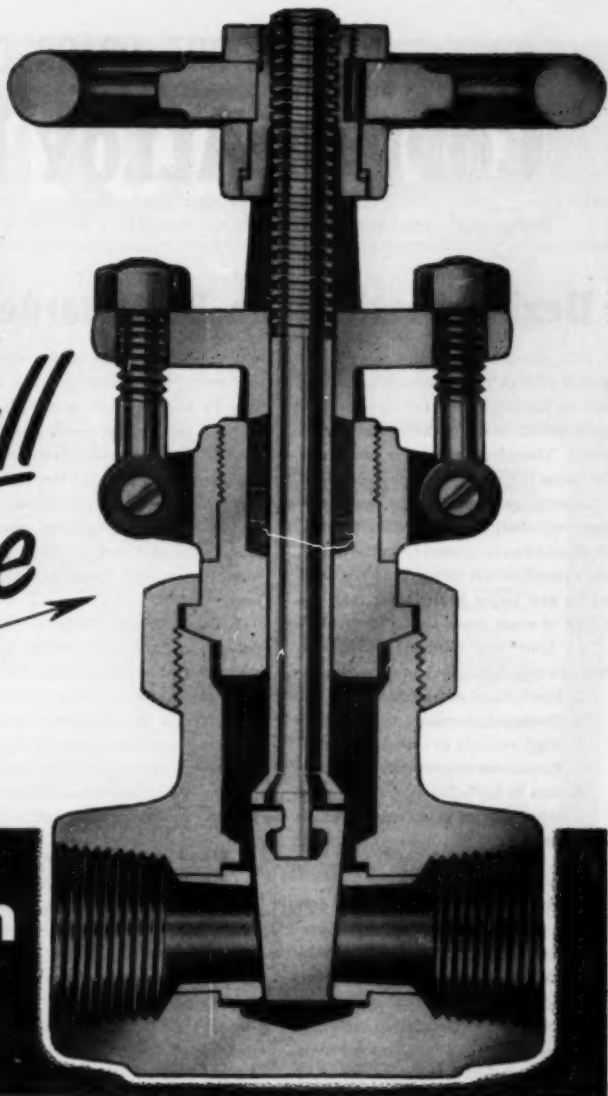
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No pressure is transmitted to the stuffing box of a Chapman List 960 when the valve is in the open position... you can always repack it easily, fast, without stopping the flow through the valve. What's more, it's a tougher — more rugged — valve that reduces many other maintenance problems.

Take for instance, the wedge faces — they're hardened to 800 Brinell by the exclusive Malcomizing process to give peak wear resistance. Seat rings, too, have unusual wear-resisting and non-galling characteristics. And, in addition,

recent design changes have resulted in stem and wedge gate connections 50% stronger than before.

Write *today* for detailed technical information. The Chapman List 960 is available in sizes from $\frac{1}{4}$ " to 2", either metal to metal or gasketed joint. Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. For higher pressures specify List 990.

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BRIDGEPORT BRASS COMPANY
CONDENSER AND HEAT EXCHANGER TUBE EDITION
COPPER ALLOY BULLETIN



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Dezincification Can Be Retarded

It is clearly evident that certain deposits of either corrosion products or porous materials may set up corrosion cells which initiate dezincification in brass. Therefore, whatever steps can be taken to prevent such deposits from attaching themselves to the metal surface will help reduce dezincification. It should be recognized from the outset that these porous deposits do not need to be any larger in diameter than the point of a pin.

At least five methods have been used to retard dezincification; namely—

1. Mechanical cleaning.
2. Chemical cleaning.
3. High velocity or turbulent flow.
4. Formation of protective coatings.
5. Use of inhibited alloys—arsenical admiralty or arsenical aluminum brass.

Effect of Silt

Muntz metal, non-inhibited Admiralty and non-inhibited aluminum brass condenser tubing, kept clean by the scouring action of small amounts of sand and certain types of fine silt entrained in the circulating water, or by chlorination and frequent brushing, have corroded at low rates (generally .001 ipy or less).

Yellow brass and Muntz metal piping and tubing kept free from various deposits have given very long service.

Effect of Turbulence

The high degree of turbulence found at the entrance end of brass condenser tubes has been observed as being very effective in preventing dezincification for a distance of a few inches up to two feet. Under very turbulent conditions dezincification has virtually been completely prevented along the entire length of such tubes. Where the turbu-

lent condition exists at the entrance end only, non-inhibited brass alloys may be subject to slow attack about .022 ipy along the remainder of the tube length. However, it must be remembered that high turbulence is often associated with impingement corrosion. Here impingement-resistant alloys such as aluminum brass, aluminum bronze and cupro nickel serve best.

It has also been observed that propellers cast from high strength brasses, which have been in constant service in sea water for many years, have shown virtually no dezincification although there may be some evidence of erosion and cavitation. On the other hand, propellers idle for some time may be subject to rapid dezincification.

Effect of Protective Scales

Certain waters which have deposited magnesium silicate or silica scales or coatings on brass surfaces are without effect on the brass. Under such conditions these silica or silicate scales are completely protective to the underlying metal and the alloy may last indefinitely. Dense adherent calcium carbonate scales are also effective in reducing or preventing dezincification but if too thick they will cut down the heat transfer rate.

Non-Sealing Waters Are Corrosive

Dezincification is most likely to occur in non-scale forming fresh or salt waters. In many instances, difficulty from dezincification in susceptible brasses is unknown until such time as a scale forming water is softened. Then it becomes necessary to use those copper-base alloys which are resistant to dezincification such as red

brass, inhibited yellow brasses, arsenical Muntz, Admiralty or aluminum brass. The other alternative is to hold the mineral balance in the water at such a level that it will be slightly scale-forming.

It has been clearly demonstrated over a period of years that the greatest difficulty due to dezincification in non-inhibited yellow brasses has occurred in non-scale forming waters. For the most part such waters have a calcium carbonate saturation index of from minus 0.5 up to minus 3.5. This is usually characteristic of a water having a low total solids and calcium content and an appreciable amount of bicarbonate.

Effect of pH Values

Dezincification can occur in fresh and salt waters with the pH ranging from 5.0 to 8.0 or higher. The pH value in itself is not particularly significant. It can, however, become very important where adjustment in the pH may lead to mineral scale formation or the dissolving of mineral scales.

Non-scale forming waters, such as a solution of sodium chloride, will lead to dezincification in a non-inhibited yellow brass in the presence of deposits at any pH value, ranging from pH 1.0 up to a pH of 12. In such media, however, the tendency of plug-type dezincification is more marked in the higher pH range and the tendency for general dezincification is greater in the lower pH range, with a rather broad twilight zone in the central section of the pH scale. This is evidently due to the solubility of the zinc corrosion products in solutions having either a very low or a very high pH value.

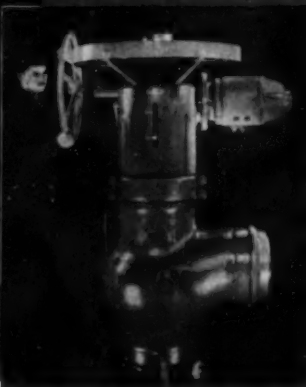
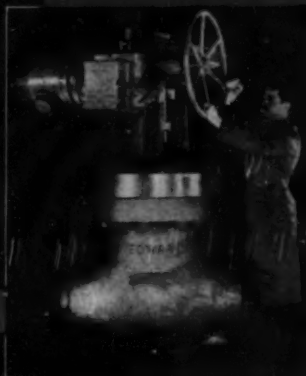
At this point, it is of interest to note that sea water having a pH of 8.0 leads to general dezincification of uninhibited Muntz metal at a rate of about .009 ipy.

(6830)

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Photos courtesy Edward Valves, Inc.

Continued advancements in the design and construction of Limitorque Valve Controls always keeps them abreast with the latest developments in valve manufacture.

Limitorque opens and closes valves of all makes and types up to 96" diameter by the "push of a button" from either remote or nearby control panels. Damage to stem, seat, disc, gate or plug is prevented because the Torque Sealing Switch limits the torque, shuts off the motor if an obstruction occurs.

Valves function at maximum desired speeds.

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Limitorque may be supplied for actuation by any available power source . . . electricity, steam, water, gas, oil or air.

Limitorque Controls are available through valve manufacturers. Thousands are in daily use on land and sea . . . in Process Plants, Refineries, Oil Pipe Lines, Power Plants, Control Stations and Water Works.

Send for our 96 page catalog. Please make request on your business letterhead.



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Limitorque Valve Controls

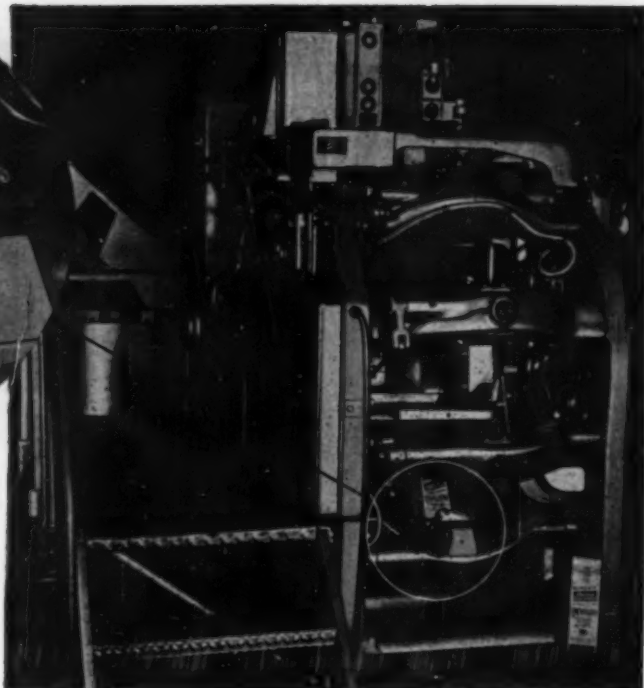


Multi-Purpose Thermostat assures uniform sealing of milk cartons

When famous Pure-Pak milk cartons were designed, a basic step in their formation was the proper sealing of the bottom flaps. The sealing was done by contact with an electrically heated block and this block had to be kept at a uniform sealing temperature.

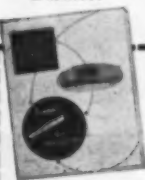
The problem was solved when Pure-Pak, a division of the Ex-Cell-O Corporation in Detroit, installed low cost Fenwal THERMOSWITCH thermostats as the temperature control units. These thermostats provide positive control, minimum maintenance, are sufficiently compact to fit efficiently on the Pure-Pak carton-forming machine. Now dairies throughout the country benefit from the sealing uniformity assured by Fenwal THERMOSWITCH Thermostats.

The dairy industry is but one of many to benefit from Fenwal THERMOSWITCH units. They effectively control many variables where heat is a factor.



Their unique principle of operation consists of a single-metal activating shell. This shell expands or contracts *instantaneously* with temperature changes, making or breaking the totally enclosed electrical contacts.

Fenwal THERMOSWITCH Thermostats can no doubt help you in your own processing. Find out how by mailing the coupon today.



FREE! Get this bulletin . . . see what Fenwal THERMOSWITCH units can do for you. Just fill in coupon and mail . . . no obligation.

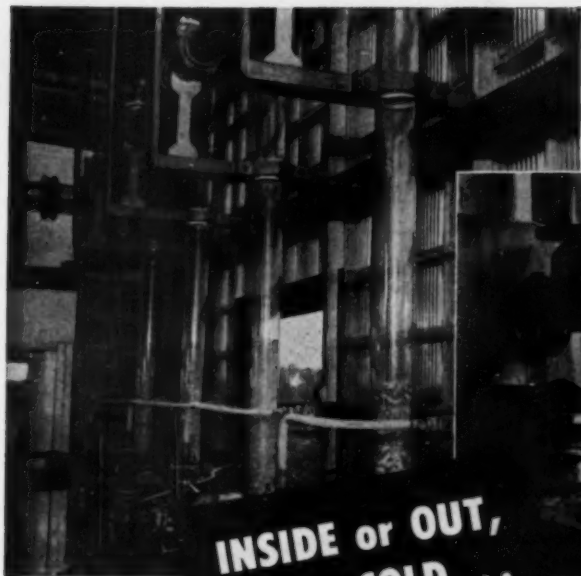
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111 South Burlington Ave., Los Angeles 4, Cal.
TEMPERATURE CONTROL ENGINEERS

Name Position
Company
Street
City Zone State

I am chiefly interested in the applications checked:

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|--|---|--|
| <input type="checkbox"/> Heating | <input type="checkbox"/> Cooling | <input type="checkbox"/> Humidity Control or Detection |
| <input type="checkbox"/> Alarm (over-temperature, under-temperature) | <input type="checkbox"/> Vapor Control | |
| <input type="checkbox"/> Timing (thermal) | <input type="checkbox"/> Radiant Heat Control | |
| <input type="checkbox"/> Pressure Control (by controlling vapor temperature) | | |

OTHER (Please fill in your special requirements)



Visual check of flow is plus advantage
only PYREX brand Glass Pipe affords
... inside or outside the plant.



**INSIDE or OUT,
HOT or COLD ...**

PYREX brand Glass Pipe *"Can Take It"*

If you believe that you must "baby" PYREX brand "DOUBLE-TOUGH" glass pipe, here are some facts that may surprise you. In use now for about 25 years, PYREX pipe has proved its dependability both inside and outside the plant (in all kinds of weather). The photographs above show typical installations ... and this pipe has been in use for a long time.

Naturally, you can't throw glass pipe around or hit it with a hammer. But with reasonable care, it has always proved a profitable investment. PYREX brand glass pipe has a very low expansion coefficient. That's why it will take temperature shock ... why it stands up in cold weather even with hot

liquids flowing through it! And there is nothing better from the standpoint of corrosion resistance—it handles anything except hydrofluoric acid.

Physically strong to start with, PYREX brand glass pipe is now made with tempered ends—we call it "DOUBLE-TOUGH." The fittings, elbows, tees, reducers, crosses, etc., are also tempered. This treatment makes PYREX pipe better than ever before. With the current shortage of many corrosion-resistant materials, take a new look at PYREX Piping. It's available without priority and at reasonable cost. Corning's Piping Distributors can help you with layout and installation. Better get the full story. Use the coupon.



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Alcoa Heat Exchanger News

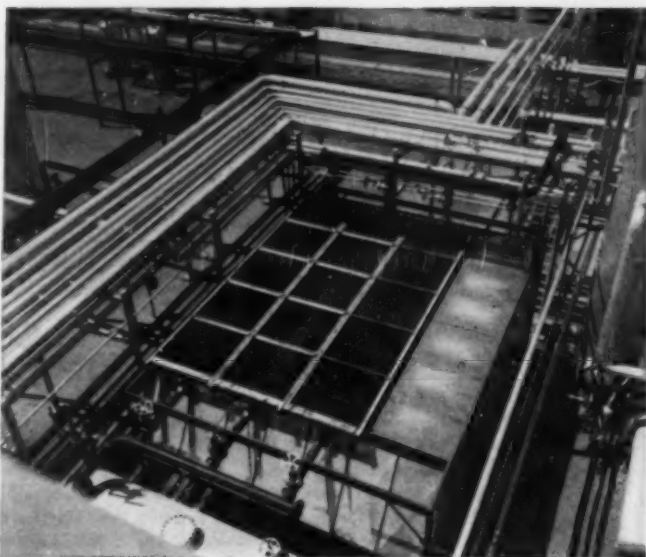


Published by Aluminum Company of America

Rearmament needs severely limit the manufacture of aluminum heat exchanger tubes. But we realize that the purchase of refinery and processing equipment requires long study of economic and performance factors. That is the reason for this message.

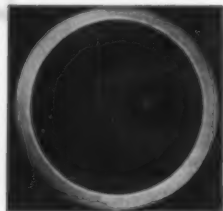
Skelly Oil Company Saves 50% IN TUBE COSTS ON AIR COOLED EXCHANGERS

At their Eunice No. 2 gasoline plant near Eunice, New Mexico, Skelly Oil Company has installed a "Fin-Fan" air-cooled unit equipped with "aluminum tubes" and "aluminum fins" as a condenser for "Still Overhead Vapors." The company's engineers chose this type of condensing equipment because the atmosphere contained hydrogen sulfide and the vapors contained hydrogen sulfide and water in corrosive quantities. In addition there was a shortage of suitable cooling water. Aluminum tubes and fins were preferred to steel or Admiralty tubes with copper fins because of their resistance to hydrogen sulfide corrosion and lower investment cost. In this particular installation Fluor Fin-Fan designed equipment with Griscom-Russell K finned aluminum tube sections was used. The aluminum tubes are rolled into cast-iron headers and no cathodic protection has been necessary. These units have been in service for over two years—show no sign of corrosion—should last 12 to 15 years based on past experience with aluminum.



ALCLAD TUBES...

a bargain in cooling water corrosion resistance



HOW THEY WORK

The thin zinc-aluminum alloy internal layer galvanically resists corrosion of the base aluminum alloy structure of the tube—acts like a "built-in" anode. Corrosion is confined within the integral cladding layer. Even when large

areas of the Alclad coating have been destroyed by electrolysis, the rest of the coating still protects the exposed alloy core. Alclad Tubes have withstood such corrosive attack for more than 17 years.

WHAT THEY COST

Foot for foot, metal for metal, Alclad Tubes cost less than any other tubes except bare aluminum. 20% less than ordinary steel. 47% less than Admiralty brass. 83% less than stainless steel.

ALCOA OFFERS BOOKLET



This 24-page booklet will answer many of your questions about Alcoa Tubes. It covers fabrication techniques, alloy selection, chemical and petroleum applications. It describes tube cleaning, inhibitors, cathodic protection. It contains complete information on fluid flow and heat transfer. There are formulas, tables and specification data. Write for your free copy today. ALUMINUM COMPANY OF AMERICA, 1860G Gulf Building, Pittsburgh 19, Pennsylvania.

Facts you should know about De Laval turbines!

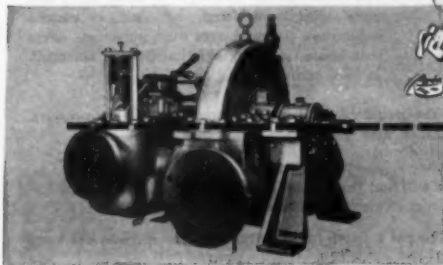


Which would
you rather sit on,
a knife edge or
a rocking chair?



The rocking chair, of course! And it's the same with the "rocking chair" type of governor pivots in De Laval turbines. The governor weights are pivoted on frictionless rolling sur-

faces. There are no heavily loaded knife edges subject to concentrated wear. This means smooth, positive action. Keeps your maintenance costs down, too.



Putting support
where it counts most!

Thermal expansion can't throw a De Laval turbine out of line with the driven machine because the body is supported at the *exact centerline* to allow for radial expansion. The front end is mounted on a flexible channel to allow for axial expansion. Thus, both radial and axial expansion can take place under extreme temperatures without disturbing the shaft centerline.

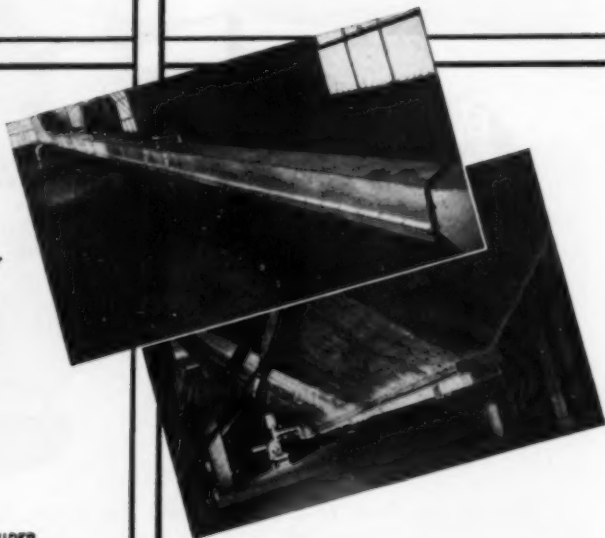
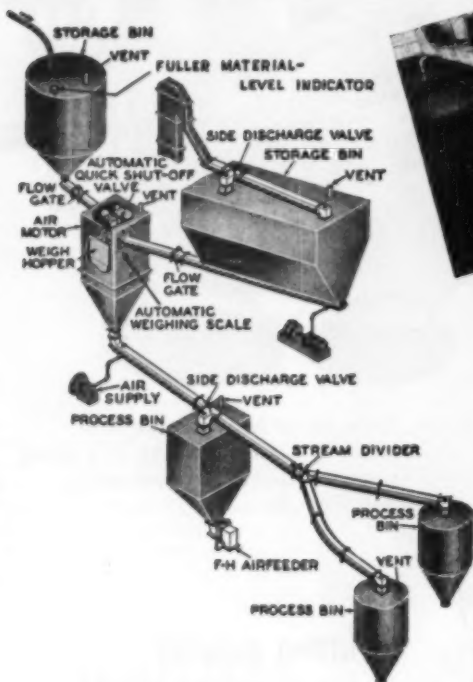
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AND COOLERS—COMPRESSORS
AND VACUUM PUMPS—FEEDERS,
AND ASSOCIATED EQUIPMENT

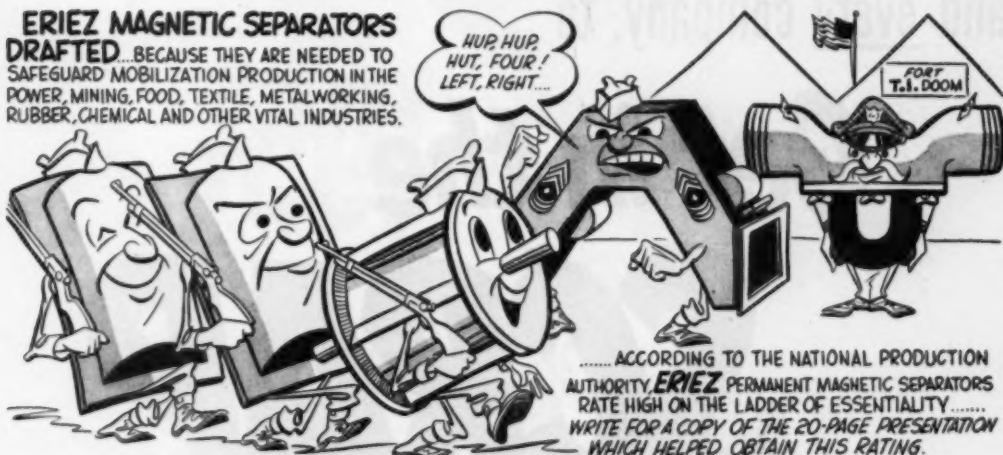
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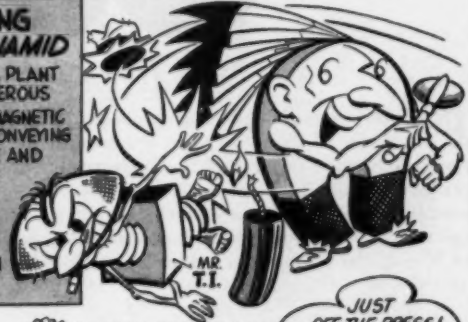
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ATOM MAGNETS TO ELIMINATE
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NOT EXACTLY, BUT A
CIGAR-MAKER FOUND 'EM
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PLATE-TYPE **ATOM** MAGNET
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WORKS LIKE A CHARM ON
OTHER PRODUCTS, TOO!



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GENERAL CATALOG
#15, WRITE NOW!

Again the time has come
to ask your company,
and every company, to

Get in the SCRAP

FOR every ton of ingot steel produced, at least a half-ton of iron and steel scrap must have previously reached the furnaces. Steel is currently being produced at full capacity, more than 100 million ingot tons annually—and there is a developing scrap shortage of serious proportions. Just as in the early years of World War II, the steel industry asks the help of all industry to relieve the situation.

TWO IMPORTANT THINGS TO DO

① CLEAN OUT YOUR PLANT SCRAP.

This is a job that every company can do. Old, worn-out or out-moded and replaced machinery and equipment, rails, structural parts,

etc. constitute the "heavy melting scrap" which the steel industry needs most. Clean up your plant and yards—move out this heavy scrap into the channels of use.

② HURRY BACK YOUR WORKING SCRAP.

Don't let the waste of metal-working—turnings, borings, punchings, crop ends, etc.—lie around the plant a day longer than necessary. Keep it moving, back to the furnaces. And doubly important, *be sure to classify and segregate your alloy steel scrap.* Thus handled, it not only commands a higher price, but will help to conserve the nation's supply of critical alloys, practically all of which are highly essential.

Contributed in the National Interest by

ALLEGHENY LUDLUM STEEL CORPORATION

Henry W. Oliver Building • Pittsburgh 22, Penna.

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IS CORROSION YOUR



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AMMONIA
HYDROGEN SULFIDE
CHLORINE
SULFURIC ACID
ETHYLENE OXIDE
CO₂
HYDROFLUORIC ACID
CAUSTIC

**HERE'S A
VALVE THAT
WILL GIVE
YOU RELIEF...**

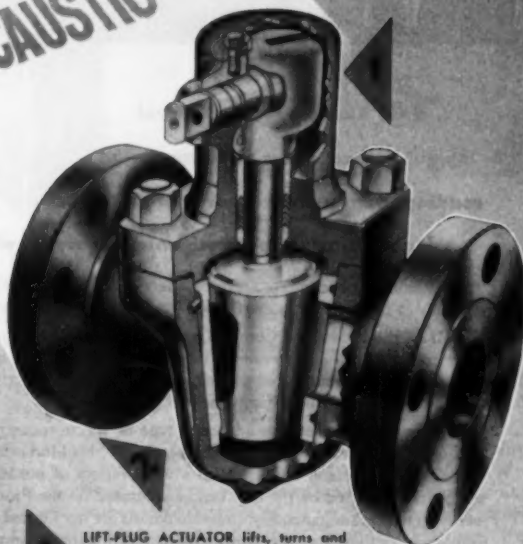
Cameron NON-LUBRICATED LIFT-PLUG VALVE

No matter what the service may be, here is a plug valve that is unique in that its seat is separate and not attached to the body and, therefore, can be trimmed in any desired corrosion-resistant alloy. Thus, the seat and plug may be replaced easily and at low cost, should it become necessary, by simply removing the bonnet. The entire operation requires only a few minutes and the valve body remains in the line. Here is, truly, an innovation in special trim valves for special services.

The Cameron Lift-Plug Valve is non-lubricated. Think of the man-hours (and grease) it will save you. This feature also prevents contamination of line products by valve lubricants. There's nothing to clog metering equipment, either.

Let us send you a booklet that tells the complete story of this remarkable valve. Like other plant operators who have purchased these valves for particularly difficult services, you may find them to be the answer to all of your problems, too.

Please write to:



LIFT-PLUG ACTUATOR lifts, turns and reseats plug in only three-quarters of a turn of the operating wrench.

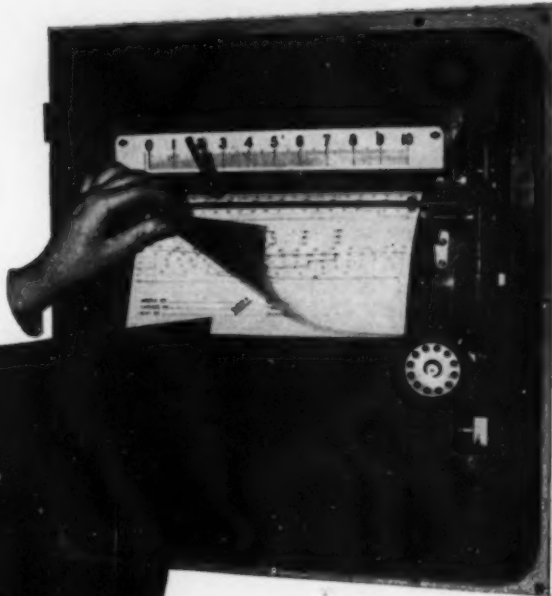
SEPARATE, RENEWABLE SEAT: Pressure-created body deflections and line strains cannot destroy the geometry of the fit between sealing surfaces because they cannot be transmitted to the separate seat.

Cameron

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metal analyses
in multiple copies

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Quantometer* gives you direct
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quantitative spectrochemical analyses with extra copies, as desired.

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*The complete ARL line also includes 1.5 and 2-meter
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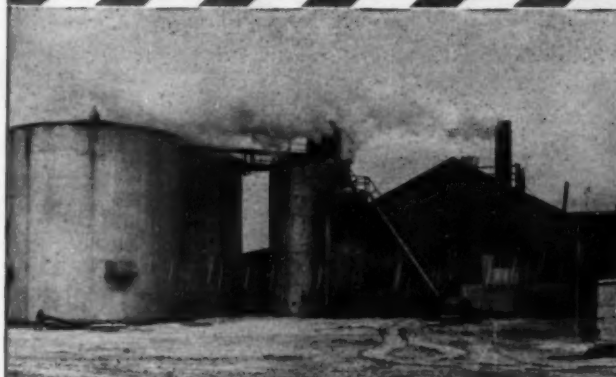


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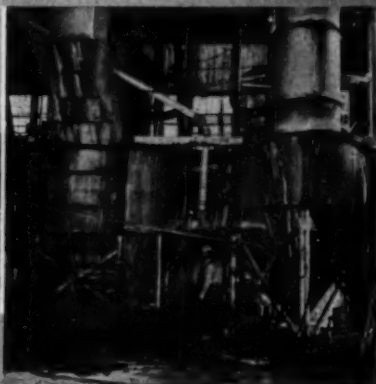
GAS-FIRED SUBMERGED COMBUSTION EVAPORATOR

is production key to
**Ozark-Mahoning Company's
Glauber's Salt Plant**



Monahans, Texas, plant of Ozark-Mahoning Company, where Glauber's Salt is produced by the Submerged Combustion Method. Vapor clouds are combustion products of this process.

Two Submerged Combustion Evaporator units in the Monahans plant.

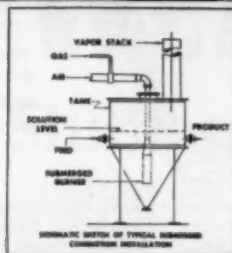


HEAT PROCESSING of Glauber's Salt requires plenty of heat, applied in a variety of ways. To combat former processing difficulties, the Monahans, Texas, plant of Ozark-Mahoning Co., Tulsa, Oklahoma, applies the "Submerged Combustion" principle—burning a Gas flame under water or liquid.

Cooper-Bessemer Gas-burning engines, totaling over 1500 HP, operate process refrigerators which chill natural brine. This brine is filtered, forming a hydrated cake (about 40% Na_2SO_4). The cake is melted and subjected to Submerged Combustion, forming a concentrated slurry which is pumped into settling tanks. Thick bottom slurry is sent to a classifier. Here dilute slurry returns to evaporators, while thickest slurry is completely dehydrated in a GAS-fired rotary kiln.

Air and Gas are burned in the Submerged Combustion chamber, under sufficient pressure to hold out the solution. Burner volume is about 2 cu. ft., in which some 139,000 Btu/min can be released. This heat evaporates large volumes of water which go into the atmosphere as steam.

Gas-fired Submerged Combustion units are extremely versatile. Largest installation to date releases 120,000,000 Btu/hr, can evaporate 1,000 tons of water daily. Products suitable for this GAS-controlled process include: heating and/or evaporation of solutions of sodium sulfate, potassium chloride, phosphoric acid, zinc chloride, waste citrus peel liquors, production of CO_2 and inert gases, etc.



Here is a Gas-fired business, utilizing the productive flames of GAS from beginning to end. GAS is always ready to serve you in unusual processes like Ozark-Mahoning's, because of its ready adaptability, accuracy of control, and efficiency. Your Gas Company Representative has the facts, and you'll get the answers if you call him today.



AMERICAN GAS ASSOCIATION

420 Lexington Avenue, New York 17, New York

give "Mr. Tubes"
a closer look
at these

ORDER DATA

to get: improved service
and material economy



Carbon, Alloy and Stainless steel tubes are defined under CMP regulations as "controlled materials". As such, they are critical materials. Not being a mind reader, "Mr. Tubes"—your B&W Tube Company representative—needs a *close* look at the following facts in order to supply the available tubing most economically suited to your requirements.



1 All related CMP authorizations and government contract numbers.



2 Any acceptable alternatives in type, finish, composition, and size.



3 A brief, informative description of your intended fabricating methods.



4 A description of the end-use, exact as to product and its service.

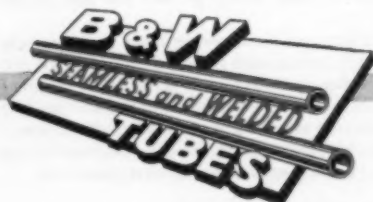
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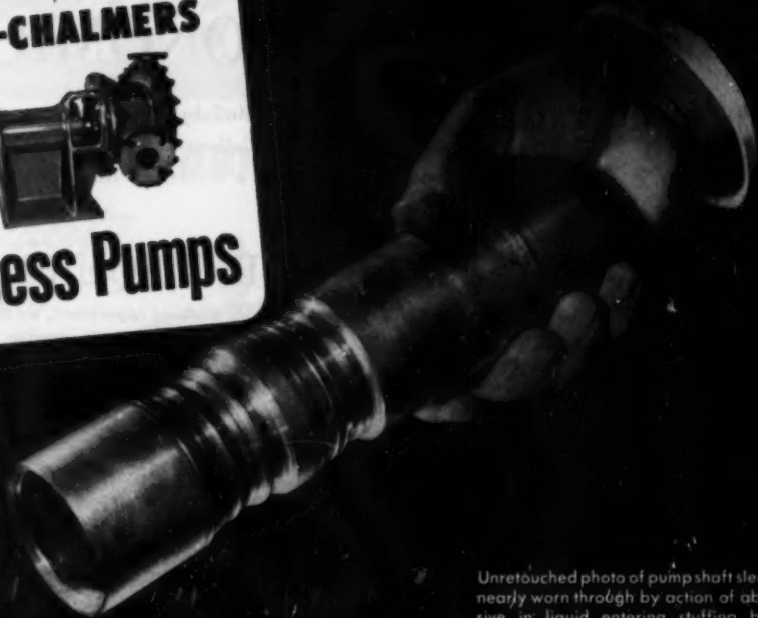


TA-1648-G

ALLIS-CHALMERS



Process Pumps



Unretouched photo of pump shaft sleeve nearly worn through by action of abrasive in liquid entering stuffing box.

STOP THIS WEAR

with New *EQUISEAL* Stuffing Box

KEEP ABRASIVES IN THE LIQUID BEING PUMPED entirely out of packing. Multiply packing life many times with new *Equiseal* stuffing box in Allis-Chalmers Process Pumps.

Here is how it works. An auxiliary rotor develops a low pressure area in front of the packing. For suction heads up to fifteen feet the pressure on the packing is zero. Consequently, the liquid being pumped will not enter the stuffing box while the pump is operating. Abrasives cannot ruin packing and shaft sleeve.

Equiseal, *Towpax* and *Vari-Pitch* are Allis-Chalmers trademarks.

Maintenance is cut to a fraction of that usually required on abrasive pumping jobs.

The *Equiseal* stuffing box is so effective that the packing may be removed while the pump is operating under positive suction head and the pump will not leak even though there is a direct passage from pump suction to atmosphere.

If you pump abrasives, you should know about the *Equiseal* stuffing box. Ask your Allis-Chalmers Sales Office for the details. Or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 08B6615. A-3249

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CHEMICAL ENGINEERING—July 1951

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CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.



TEXROPS — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

Remove Industrial Contaminants Successfully and ECONOMICALLY

You know that national, state and local air regulations are becoming more stringent annually. Air cleaning equipment, has progressed to a degree of perfection unknown a few years

ago. Buffalo Forge Company, working on actual installations as well as in the laboratory presents a diversified line of ECONOMICAL . . .

"Buffalo"

AIR CLEANING EQUIPMENT

Backed by more than fifty years of air washing experience, we now offer wet-type air cleaning devices for contaminants which are toxic, erosive, corrosive or just a nuisance. All "Buffalo" equipment is designed to provide maximum efficiency, with ease of handling and operating, together with moderate initial cost and low maintenance cost.

5

PROVEN TYPES—

Because no one type of cleaner will meet all conditions successfully, we have available 5 different wet types—all PROVEN in actual operation in industry. In addition to individual applications, they are sometimes used together. They are:

1. The Air Washer Group—Static Washer, Wet Cell, Combination, and Triple Bank Washer
2. Hydro Volute Scrubber
3. Cupola Washer
4. Hydraulic Scrubbing Tower
5. Multistage Gas Scrubber



Send for
Bulletin 3181-B
describing the 5 types of Industrial Air Cleaning Equipment—
No obligation.

No matter what your contaminant—dust, fume, gas, vapor mist smoke or fog, our past experience will be valuable to you in selecting the proper equipment or combination to do a first class removal job. Remember, we are interested in the most economical way to handle your problem. So are you . . .

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SPECIFIC RECOMMENDATIONS!

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Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch offices in all Principal Cities

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FORCED DRAFT

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AIR TEMPERING
HEATING

INDUCED DRAFT
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Line-O-Power

STRAIGHT LINE DRIVES

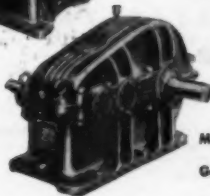
*...for quality...
economy...
efficiency...*



QUALITY that starts with Duti-Rated, high hardness, precision helical gears, assembled into rugged cast housings of compact, streamlined design.

ECONOMICAL to buy because the latest, most accurate high production machine tools assure rapid production with exceptional accuracy for long wear life. Economical to operate because simplified construction, minimum number of moving parts, direct splash lubrication, quality workmanship—all hold maintenance to a minimum.

FOOTE BROS. manufactures a complete line of enclosed gear drives to meet any requirement.



EFFICIENCY—Straight line design with Duti-Rated helical gears gives efficiencies of 96%, or higher.

Line-O-Power Drives are available in double or triple reductions for capacities from 1 to 200 h.p. with ratios from 5 to 1 up to 238 to 1.

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FOOTE BROS.

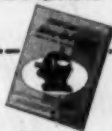
Better Power Transmission Through Better Gears

WRITE FOR BULLETIN LPB

Foote Bros. Gear and Machine Corporation
Dept CE, 4545 S. Western Blvd.
Chicago 9, Illinois

Please send me a copy of Bulletin LPB on Foote Bros. Line-O-Power Drives.

Name.....
Company.....
Position.....
Address.....
City..... Zone..... State.....



how to prevent the wrong reaction . . .



...the Versenes*

VERSENE® — THE OUNCE OF PREVENTION

The wrong reaction in chemical processes always spells trouble with a capital "T." This kind of trouble is always expensive. It creates confusion, costs money, wastes time, spoils goods, reduces yields, loses business and wipes out good will. The intelligent use of one or more of the Versenes can *prevent* wrong reactions caused by certain things such as metallic impurities or contaminants in commercial grade chemicals and equipment.

HOW THE VERSENES® WORK

The Versenes are the tetra sodium salts of ethylene diamine tetra acetic acid and other polyamino acids. They are among the most versatile and powerful chelating (complexing) agents known. They complex any di- or tri-valent metallic ions efficiently and economically and are completely stable in hot alkaline and acid solutions. The Versenes react with most metallic ions to form soluble non-ionic metal chelate compounds. These powerful, complex compounds inactivate the metallic ions so completely that they cannot be precipitated by common precipitating agents. 500 grams of dry, or 1500 grams of liquid Versene will complex one mole of metallic ions.

VERSENES® ARE AVAILABLE

There are now 7 Versenes. Each has special applications but all help give the *right* reaction every time — despite metallic contaminations. A clue to your problem places a generation of experience in pioneering the polyamines at your disposal. Send for Technical Bulletin #2. Samples on request. Write Dept. B.

NEW VERSENE WATER TEST KIT. Tells total hardness in 2 minutes. Accurate to one grain per gallon. Versenate Method. Complete Kit \$5.00 postpaid.



BERSWORTH CHEMICAL COMPANY
FRAMINGHAM, MASSACHUSETTS

*Trade Mark

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Providence, Rhode Island
W. Coast Agent: Griffin Chemical Co., San Francisco, Los Angeles

Warehouse Stocks
Midwest Agent: Kraft Chemical Co., Inc., 917 W. 18th St., Chicago
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SOLVAY

TRADE MARK REG. U. S. PAT. OFF.

offers

3 Dependable Technical Services



3—LABORATORY SERVICE. One section of the new SOLVAY alkali research laboratory—the largest and best equipped alkali research laboratory in the world. Here in this modern laboratory, your chemical, engineering and operating problems can be studied and analyzed with the most advanced facilities.

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CHEMICAL ENGINEERING—July 1951



1—FIELD SERVICE. SOLVAY "Industry-Wise" TECHNICAL SERVICE is a specialized service, exclusive with SOLVAY. It consists of men who are authorities on the uses and applications of alkalies to individual industries. The work of these technicians is not confined to trouble shooting alone. Even if your operations are functioning smoothly, SOLVAY TECHNICAL SERVICE may help you by suggesting new procedures . . . reducing costs.



2—TECHNICAL LITERATURE. SOLVAY's series of technical bulletins are a highly reliable source of information. Because of the authentic data and careful compilation of these bulletins, operating plants and research laboratories—in industry and in educational institutions—have come to depend on SOLVAY Technical Bulletins. Any one or all of these bulletins are available to you on request.

Bulletin No. 5—Soda Ash

No. 6—Caustic Soda

No. 7—Liquid Chlorine

No. 8—Alkalies and Chlorine in the Treatment of Municipal and Industrial Water

No. 11—Water Analysis

No. 12—The Analysis of Liquid Chlorine and Bleach

No. 14—Chlorine Bleach Solutions



4 WAYS TO DE-IRON Materials Carried on Conveyor Belts

DINGS magnets offer a variety of ways to meet problems caused by tramp iron—problems such as fires, explosions, machinery damage or product purification.

One of these ways is the ideal way and its choice is a joint affair—yours and ours. Outline your application to Dings. You can rely on their unbiased recommendation.

The magnets listed are but part of a complete line of magnetic separators which includes magnets for chutes, ducts, wet applications or fully self contained units. For a description of the complete line . . .

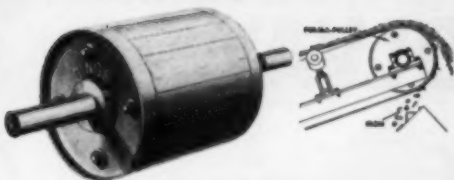


Send For Catalog
C-5000 A

In it can be found
the answer to any
magnetic separation
problem.

DINGS MAGNETIC SEPARATOR CO.
4730 W. Electric Avenue, Milwaukee 46, Wis.

Dings



1. DINGS PERMA-PULLEYS

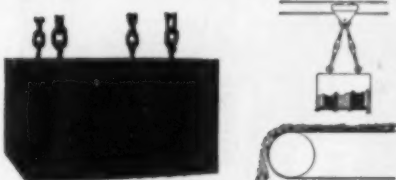
INTENSELY concentrated magnetic strength near the surface makes this the magnet to use where burden depths do not exceed 3". Installed as head drive pulley, tramp iron removal is fully automatic, simple. Non-electric, permanently energized it can be installed and forgotten. Catalog C-1007 A gives details.

Powerful, air-cooled electro magnetic pulleys are available for burden depths exceeding 3". Low operating cost, long life and extreme power characterize this work-horse of the Dings line. Catalog C-1001 A.



2. DINGS PERMA-PLATES

PERMA-PLATES are the simplest, most economical magnets available. Installed over the conveyor belt, they are extremely effective on shallow burden depths. Non-electric and permanent. Perma-Plates can be made self-cleaning. Catalog C-1205 A.



3. DINGS SUSPENDED RECTANGULARS

FOR the difficult jobs. Power close and power that searches down 12" to yank tramp iron out. Triple pole, double gap design gives edge to edge protection that can't be surpassed. Install horizontally, vertically or at an angle. Self-cleaning fully automatic models also available. Another model, the DEEP BURDEN Rectangular, is effective at distances to 18". Catalog 301-A.



4. DINGS MAGNETIC DETECTOR

THE Dings Magnetic Detector instantly signals when any magnetic object passes through the detector zone. Can be hooked up to sound an alarm and stop the belt. Ideal where the infrequency of tramp iron does not warrant the use of a magnetic separator, or where heavily loaded, high speed conveyor belts make iron extraction magnetically an impossible task.



Finishing Building with
Boiler Plant in
left background

FROM REPORTS . . . to *Producing Plant*

For Lever Brothers Limited, Stone & Webster Engineering Corporation prepared a series of reports covering alternative plans for consolidation and expansion of the company's manufacturing facilities in Toronto.

The resulting new plant facilities, selected to achieve more efficient and economical operation, were designed and constructed by Stone & Webster Engineering Corporation.

Left to right, Boiler Plant, Glycerine Refinery and Finishing Building which includes manufacturing equipment for soap products and toilet preparations.



STONE & WEBSTER ENGINEERING CORPORATION
A SUBSIDIARY OF STONE & WEBSTER, INC.

WHERE you get it... DOES make a difference



When you place your order with Barrett you're assured prompt, dependable service and top quality products, backed by 97 years of successful manufacturing experience.

WHEN YOU NEED A COAL-TAR CHEMICAL

Phenols
Cresols
Cresylic Acids
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Xylenols
Pickling Inhibitors
Benzol
Toluol
Xylol
Naphthalene
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ELASTEX® DCHP Plasticizer
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Phenolic Resins
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Pyridines
Picolines
Quinoline

Lutidines
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Indene Resin
Carbonex® Rubber Compounding
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Bardol® Rubber Compounding
Oil
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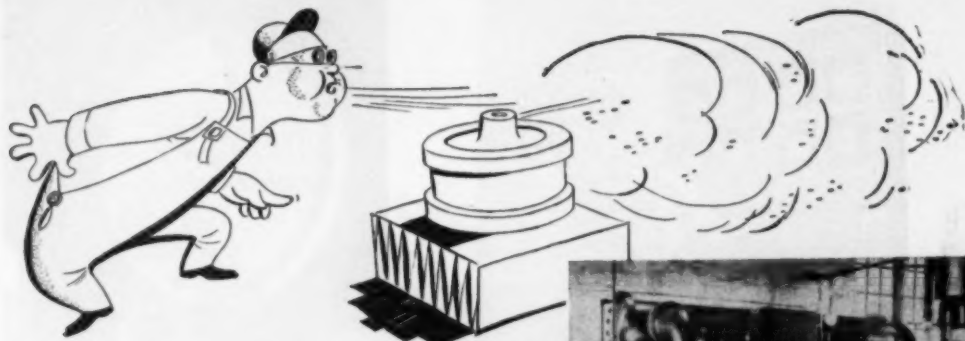
GET IT FROM...



THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

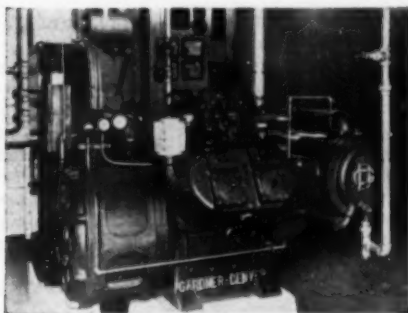
*Reg. U. S. Pat. Off.

You don't have to skimp on compressed air!

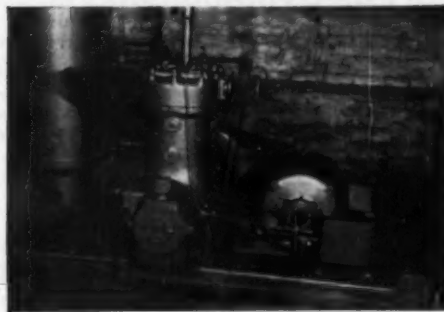


An ample supply of compressed air arms you with many opportunities to speed production—conserve man-hours—hold costs in line. Especially when it's the lower-cost-per-cubic-foot air from a Gardner-Denver Compressor.

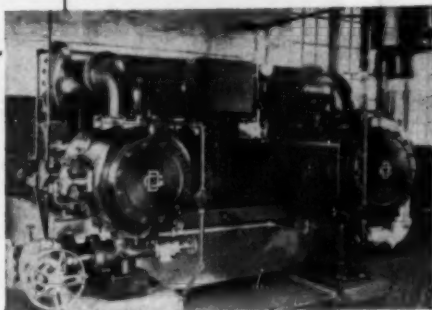
Backed by more than 90 years of quality manufacturing, Gardner-Denver Compressors handle constant peak loads—dependably . . . keep maintenance and operating costs so low you can use compressed air throughout your plant—without skimping. Write us today for complete information.



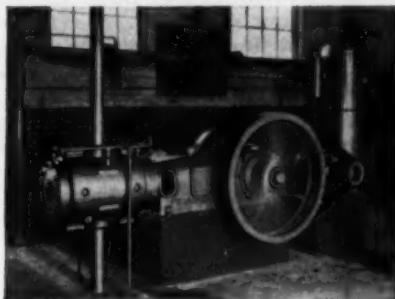
WB Two-Stage, Vertical Compressor 142
to 686 cu. ft. displacement per min.



AA Single-Stage, Vertical Compressor 32
to 183.6 cu. ft. displacement per min.



HA Two-Stage, Horizontal Compressor 593
to 1854 cu. ft. displacement per min.



RX Single-Stage, Horizontal Compressor
89 to 1292 cu. ft. displacement per min.

SINCE 1859

GARDNER-DENVER

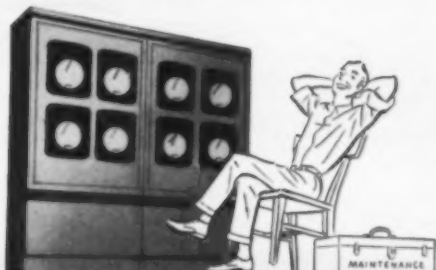
Gardner-Denver Company, Quincy, Illinois, U. S. A.

In Canada:

Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

WHY maintenance men
breathe easier...



DYNALOGS* have

No slidewire • No Balancing Motor • No Batteries to standardize

PRACTICALLY NO MAINTENANCE

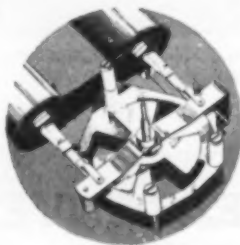
With Dynalog Recorders and Controllers, maintenance men are freed from hazards of sticking electrical contacts and worn slidewires... freed from routine lubrication and cleaning of balancing motors, periodic standardizing and replacement of batteries. No wonder maintenance men breathe easier!

The simplicity of Dynalog design is one reason for its unequalled freedom from maintenance. In the entire balancing mechanism there are only four moving parts (none moving faster than the pen). It's free from the gears, cables, etc. used in conventional

bridge-type instruments... the result of advanced engineering from concept to construction.

Freedom from maintenance is only one of many important advantages of Dynalog Instruments. They offer... *speed* that's full scale to new balance in as little as one second... *sensitivity*, one ten-thousandth of scale... *accuracy*, $\frac{1}{4}$ of 1% of scale. Available for measurement and control of temperature (with resistance bulbs or thermocouples), humidity, pressure, flow, force, pH, conductivity, etc. Get the complete story in Bulletin 427-1. Write The Foxboro Company, 387 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U. S. Pat. Off.



The heart of Dynalog superiority

It's a simple variable capacitor! Taking the place of the conventional slidewire, this important component gives Dynalog Instruments absolutely **STEPLESS** continuous balancing. It gives you an instrument of extreme accuracy and stability, with a sturdiness that withstands the most severe industrial conditions.

FOXBORO DYNALOG*

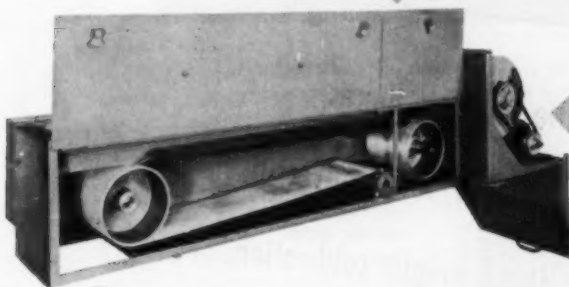
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The electronic potentiometer that has NO SLIDEWIRE

FOR THE *Ultimate*
IN CONTROLLED-STREAM
WEIGHING!
... COMBINE A
RICHARDSON SCALE
WITH THIS NEW
SMALL BELT FEEDER



Richardson E-50 Automatic Bulk Hopper Scale



Richardson C-10 Small
Belt Feeder—the only con-
tinuous feeder giving bag-
ging scale accuracy

Here's a combination of Richardson equipment that offers you self-testing in continuous feeding by ironing out en masse discharges from intermittent weighing operations. An automatic hopper scale and this short take-away feeder provides a speedy and accurate method for delivering a continuous pre-weighed stream of dry, ground, granular, dusty or sluggish materials.

Complete tonnage control of the "feeding stream" on a per minute basis is secured by the inclusion of Richardson Timer Control in the circuit, whereby the scale will discharge automatically at selected time intervals to the controlled continuous feeder.

The new Richardson Belt Feeder is totally enclosed yet fully accessible. Its compactness makes it ideal for installation in tight places and where a continuous stream of material is to be delivered from the hopper of an intermittently discharging scale. An important feature is its cantilever pulleys for endless belting.

A variable speed drive can be furnished which is automatically adjustable to vary the stream in conformity with the timed discharges of the scale above, and so maintain a continuous stream, accurate by weight. Available lengths—18" to 60"; stream widths—2", 4" and 6". Capacity up to 1500 Cu. Ft./Hr.

Richardson Scale Co., Clifton, New Jersey. Feeder-Weigher Systems of All Types: Automatic Bulk Weighing Hopper Scales, Including Conveyor-Feed Types—Continuous Feeder-Weighers—Automatic Bagging Scales—Bag-Sewing Conveyors—Packers—Process Control Panels. Branch offices in: Atlanta • Boston • Detroit • Minneapolis • Cincinnati • Wichita • Montreal • Omaha • New York • Pittsburgh • San Francisco • Toronto • Buffalo • Chicago • Philadelphia • and Houston

Richardson

MATERIALS HANDLING BY WEIGHT

Few meters have
ANY *of these features—*

only **HAGAN**
RING BALANCE
has **ALL**

1. No stuffing boxes.
2. Mercury level not critical.
3. Dead-weight calibration.
4. Adjustable over a 7 to 1 range of differentials.

For full information on these meters, or on any application in which you are interested, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

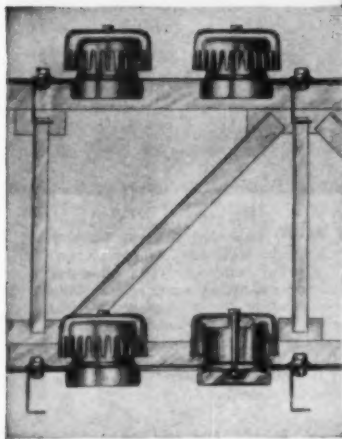


HAGAN CORPORATION
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
~~THROTTLING~~ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

"the last word" in
bubble tray improvements



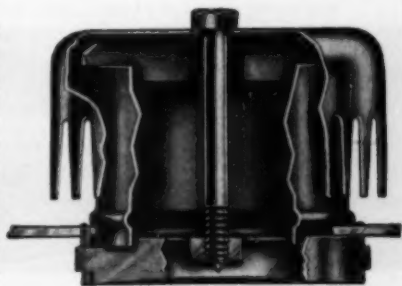
Gilbarco LIGHTWEIGHT ALLOY BUBBLE TRAYS



NEW CAP ASSEMBLIES—New design makes possible quick, easy removal by one man, working from top side. Flush tray surface, without flanges and projecting edges around holes, makes cleaning faster and easier.

NEW BRIDGE-TYPE TRUSS DESIGN

One truss for every two trays when long spans are necessary . . . with every alternate tray level free of major supports. Gilbarco Duo-Level Alloy Bubble Trays are faster to install, far easier of access, more rigid with lighter weight.



NEW CLAMP DESIGN—Decreases joint leakage with minimum amount of packing.

AS NEW EQUIPMENT OR REPLACEMENTS—Gilbarco's large staff of engineers is at your service to demonstrate how Gilbarco Bubble Trays can be fabricated to meet the requirements of your process design.

Gilbarco

**GILBERT & BARKER
MFG. CO.**

West Springfield, Mass.—Toronto, Canada
Established in 1865



PEERLESS *builds* *dependable* *pumps...*



PEERLESS TYPE A high quality GENERAL PURPOSE PUMPS FOR WATER SUPPLY AND BOOSTER SERVICE. Horizontal split case, single stage design with double suction impellers and ball bearing construction. For water and clear alkaline fluids. Available in sizes from 1½" to 48" discharge. Capacities up to 70,000 gpm. Heads: up to 300 feet. All types of drive. Rugged in construction; many outstanding design features, high efficiency ratings over entire range of sizes. Bulletin B-1300 describes Peerless Type A pumps in detail.

HERE ARE THREE HIGHLY
EFFICIENT WATER HAND-
LING PUMPS COMBINING
SUPERIOR DESIGN,
QUALITY CONSTRUCTION &
EXCELLENT PERFORMANCE



PEERLESS TYPE PE-PB economical GENERAL PURPOSE PUMPS — One of the broadest lines of end-suction, single stage, horizontal pumps for most all water handling services offered by any manufacturer. Both fractional and integral hp, direct connected electric (Type PE) or belted (Type PB) models available. H.P. range: ¼ to 150 hp. Capacities: 10 to 5500 gpm. Heads: to 200 feet. Excellent hydraulic characteristics. Bulletin B-2300 describes the Peerless Type PE and PB pumps in detail.



PEERLESS TYPE TU-TUT multi-stage GENERAL AND SPECIAL PURPOSE PUMPS. For application to both process water pumping, boiler feed water service and some process liquids against higher heads than single stage pumps; two stage (Type TU) and 3, 4 and 5 stage (Type TUT) models are available. Horizontal split case design Type TU has low loop crossover; Type TUT has high loop. Capacities: 50 to 3500 gpm. Heads: up to 1600 ft. All types of drive available. Bulletins No. 301 and No. 310 describing both types are available.

WRITE FOR BULLETINS . . .

Upon request, Peerless will send individual bulletins on most every pump, both horizontal and vertical, in its complete line of water handling pumps. Write today for information on the type you require.

PEERLESS PUMP DIVISION FOOD MACHINERY AND CHEMICAL CORPORATION

Address inquiries to Factories at:

Los Angeles 31, California and Indianapolis 8, Indiana
Offices: New York, Chicago, St. Louis, Atlanta, Dallas, Plainview and Lubbock,
Texas; Fresno, Los Angeles; Phoenix; Albuquerque, New Mexico.



MPS-500

an important new plasticizer for vinyl compounds

**Low cost and desirable properties make MPS-500
an attractive plasticizer for vinyl compounds.**

MPS-500 is a stabilized, chlorinated fatty acid ester. It shows excellent compatibility with vinyl chloride polymers and copolymers, and exerts a strong plasticizing action on them.

It is flame-retardant; has excellent low migration characteristics, and imparts very good electrical properties.

Compositions containing MPS-500 show good flexibility at ordinary and low temperatures, good all-around mechanical properties and good processing characteristics.

Particularly valuable is the high permanence of the compositions, showing very low plasticizer loss on heating and on extraction with water and oil.

Used alone, MPS-500 compares closely with tricresyl phosphate in efficiency. However, it is superior to the latter in low-temperature flexibility. Its use with other plasticizers makes possible a wide range of desirable properties.



SEND FOR THIS NEW BULLETIN

BULLETIN 35 contains properties of MPS-500; comparisons with other plasticizers; effects of aging by heat, water and gasoline; recommended stabilizers; and typical formulations and uses. Write today, on your company letterhead, for a copy.

From the Salt of the Earth

HOOKEE ELECTROCHEMICAL COMPANY

5 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.

NEW YORK, N. Y. • WILMINGTON, CALIF. • TACOMA, WASH.



1-629

BENZOIC ACID • CHLOROTOLUENE • SODIUM BENZOATE • CAUSTIC SODA • MURIATIC ACID • CHLORINATED PARAFFIN • CHLORINE

CHEMICAL ENGINEERING—July 1951

355

recovered oil pays for Cyclator® Operation

AT THIS OHIO MANUFACTURING PLANT

*Effluent Sparkles in
Golf Course Stream*

THIS large Ohio manufacturing plant had over 100,000 g.p.d. of waste liquids, including pickling acids, chrome plating residues, cutting oils and alkaline cleaner solutions. With the Cyclator and a primary clarifier the effluent is so clean it furnishes the main flow for a nearby golf course stream! Chemical cost of \$12.00 per day, the salary of a part-time operator and other running expenses are more than paid for by recovered oil.



**Here's an Amazing
Waste Reduction Story:**

*Soluble and insoluble oil
from 2950 to 15 p.p.m.
Chromium reduced to .1 p.p.m.
BOD of alkaline waste
from 2000 to 30 p.p.m.*



INFILCO INCORPORATED

Tucson, Arizona

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

World's Leading Manufacturers of Water Conditioning and Waste-Treating Equipment



A "K" Monel doctor blade in use on a soap flaker dryer roll. After 7 months of highly satisfactory service, this blade was transferred to rolls used for polishing soap, setting a record for doctor blade longevity in the plant.

The Doctor Was a Headache ...until they tried "K" MONEL

In a soap flake plant, flaker roll doctor blades were a source of considerable trouble and expense.

The blades were operated against a cast iron cooling roll, 5 ft. in diameter with a 90 in. face, which handled 72,000 pounds of soap every 24 hours.

Although made of the finest Swedish steel, doctor blades had to be honed every hour, and reground every 24 hours. It took only ten minutes to change a blade, but in that short time 500 pounds of soap production were lost.

After putting up with the problem for some time, plant engineers decided to try doctor blades made of "K" Monel®.

Results? Judge for yourself! Here is what the plant engineers reported:

1. "K" Monel doctor blades (0.031 in. thick by 4 in. wide) required honing only once in 24 hours.
2. "K" Monel blades gave 27 continuous days of service before needing regrounding.
3. It took more than 7 months to reduce the width of a "K" Monel blade from 4 in. to 2¾ in.

Switching to "K" Monel doctor blades gave them 24 times more service between honings, 9 times more service between regrinds, and saved uncalculated production poundage formerly lost through frequent blade changes.

Not always, of course, can such spectacular gains be made merely by changing the material of a doctor blade. But here's something to remember—

There are special Inco Nickel Alloys for almost every doctor blade application... alloys that have a proved record of reducing maintenance costs and speeding production.


Find out more about these important alloys by asking for your copy of: "How to Get More Production from Doctor Blades." Right now, of course, INCO Nickel Alloys are being diverted more and more to defense production, so you may have to wait for the metal you want.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.


INCO
NICKEL  ALLOYS

MONEL® • "K" MONEL • "KR" MONEL • "R" MONEL • "S" MONEL
NICKEL • LOW CARBON NICKEL • DURANICKEL®
INCONEL® • INCONEL "X"®


Need special
high pressure
gaskets
such as these?



Flare-type Gasket
with Bellows Action



Delta Joint
Gasket



Pressure Seal
Joint Gasket

We tailor them to your specifications

If you require high pressure gaskets made to extremely close tolerances—for service exceeding 10,000 psi, for example—and fabricated to any desired diameter or cross-section, why not look into the special service that Goetze offers for making these gaskets to your order.

The gaskets shown above are typical of the wide variety for high pressure service that have been made to order for Goetze customers. The flare type gasket with bellows action illustrated at upper right is but one example of what Goetze "know-how" can accomplish.

Goetze has had over sixty years of experience in making specialized metallic gaskets for industry's most complex jobs. Modern machines—many of them specially designed and built by Goetze—enable Goetze craftsmen to produce gaskets of any required design, shape or size...and deliver them with remarkable promptness.

For further information about Johns-Manville Goetze gaskets, write for a copy of the new Goetze Gasket Catalog. Or send us a drawing or template for assistance on your specific problem. Address Johns-Manville, Box 290, New York 16, N. Y.

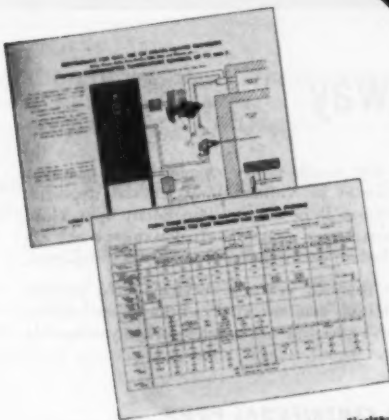
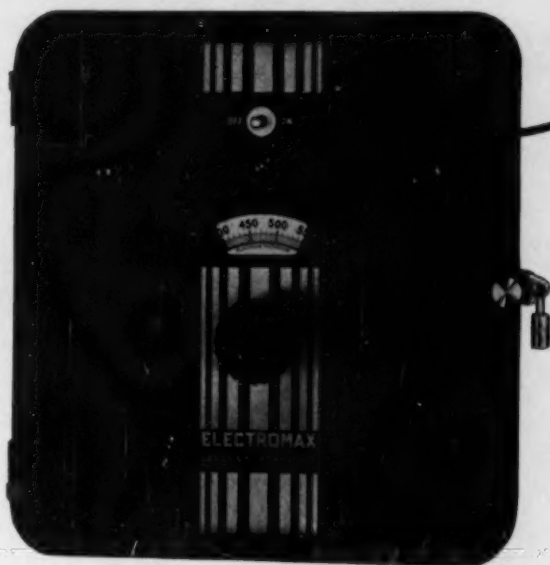


Johns-Manville *Goetze* **GASKETS**

THERE'S A JOHNS-MANVILLE PACKING
AND GASKET FOR EVERY SERVICE.

Dependable temperature control to 1000 F

Connection between the instrument and its primary element (a Thermomax temperature detector) is wire . . . not tubing. Can be any length without affecting accuracy or dependability.



Typical samples of the information available on Electromax Control. Specify nature of process and whether fuel is gas, oil, steam or electricity.

ELECTROMAX Controllers give modern electronic regulation to thousands of important manufacturing processes. In any application up to 1000 F they exactly fill the bill for non-recording controllers of outstanding dependability.

Electromax has the sensitivity, accuracy and dependability of its big brother Speedomax Recording Controller. Likewise, it is not affected by vibration or building tremors . . . can even be mounted on the frame of a molding press. The instrument needs almost no attention, because it has only one moving part . . . a covered plug-in type relay. There's usually no need to open the instrument door for months at a time.

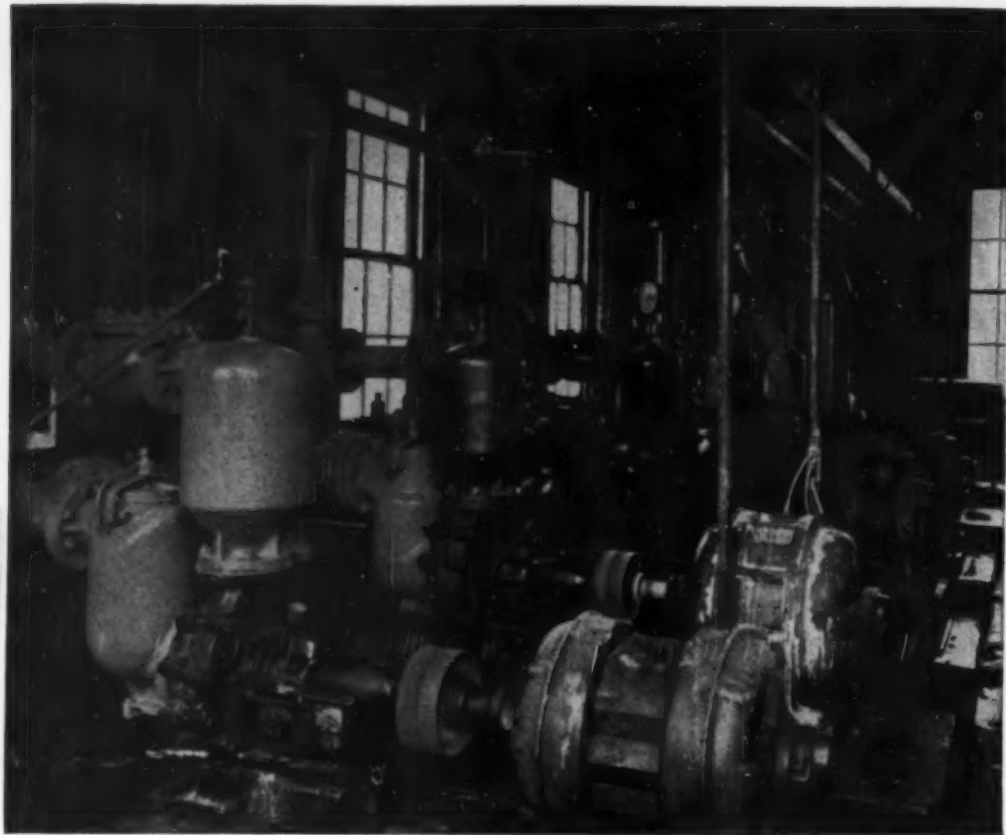
Electromax Control is available to provide any one of three control actions. For the more simple process requirements, on-off or two position control is usually used. For processes requiring control within unusually close limits, two different types of proportional control are available . . . Position-Adjusting Type and Duration-Adjusting Type. All three types of control action can be applied to electric, steam or fuel heating.

For further information, write our nearest office, or 4916 Stenton Ave., Phila. 44, Penna.

31 A4 ND47(2)

CHEMICAL ENGINEERING—July 1951

LEEDS & NORTHRUP CO.
MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES



Salting It Away

Although salt brine isn't particularly difficult to handle, this manufacturer wanted tops in dependability. So he chose LaBour for a battery of pumps that had to be on the job or else. (The "else" means here, as in so many plants, a lot of dollars lost in production, wasted material and maintenance labor.)

The LaBour pumps prime themselves quickly when necessary, cannot air bind, yet have neither

valves nor small, easily clogged fluid passages which would be vulnerable to crystal deposits. Effectiveness is in no way dependent upon close clearances, hence wear or corrosion must reach extremes before performance is noticeably impaired.

More than 28 years of service to the process industries has demonstrated LaBour dependability. You aren't guessing—or hoping—when you specify LaBour.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LaBOUR

THE LaBOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.



What every H_2SO_4 Producer should know about Molten Sulfur Filtration

HERE'S HOW TO BOOST ACID OUTPUT AND REDUCE COSTS—IN ONE MOVE

Contact sulfuric acid producers can increase production considerably above rated capacity, and cut operating costs proportionately, simply by putting Niagara sulfur filters ahead of the burners.

These are the proved results of Niagara filtration in existing contact acid plants:

REDUCTION OF SHUTDOWNS THROUGH DIRT ELIMINATION . . . Filtration removes the cause of shut-downs, by eliminating dirt *before it enters* the acid train. Niagara-filtered sulfur has an average ash content of .005% or less.

LOWER OPERATING PRESSURE . . . As a result of ash reduction, pressure rises are infinitesimal. In one plant, pressure rise in 3 years was a fraction of an inch vacuum.

LOWER CATALYST COST . . . Catalyst cleaning is almost eliminated. With dirt eliminated, the percent of dust actually carried into the converter is negligible.

CORROSION REDUCTION . . . The Niagara filtration process dehydrates and neutralizes the sulfur, with resultant decrease in corrosion from acid and moisture throughout the plant.

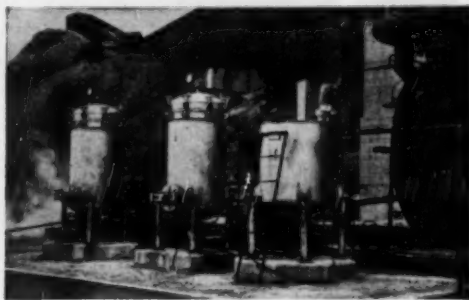
REDUCTION OF "PLUGGING AND SULFATING" . . . Pumps, guns and other equipment require less maintenance and cleaning, as a result of the purer neutralized sulfur.

SIMPLIFIED SUPPLY PROBLEMS . . . Off-color grades of sulfur may be processed, with good results.

Saves Construction in New Plants

New contact acid plants can be constructed more cheaply if a Niagara packaged sulfur filter system is installed. Settling pits and gas filters can be eliminated.

Melting pits can be made smaller, since agitation



TONNAGE WENT WAY OVER RATED CAPACITY when this compact Niagara Filter System was installed in 150-ton sulfuric acid plant. Filters handle 50 tons of molten sulfur each 24 hours. They are cleaned by one man in one hour once a week.

can be incorporated without danger of stirring up dirt from the bottom of the pits.

A Niagara sulfur filter system requires low initial investment, takes up little space, and needs no additional labor. Daily operating costs are usually less than one cent per ton of acid produced.

Modern sulfur filtration, which today accounts for some 2,000,000 tons of U. S. annual acid production, was developed and pioneered by Niagara engineers. Many Niagara sulfur filter systems are in operation throughout the country. For full details on the type of system that will best help your acid production in the present emergency, send in the coupon or write us today.



Niagara Filter
CORPORATION

IN EUROPE—NIAGARA FILTERS EUROPE,
36 Leidsegracht, Amsterdam-C, Holland

NIAGARA FILTER CORP.
3087 Main St., Buffalo 14, N. Y.

Please send full information on Niagara Sulfur Filter Systems.

Name

Title

Company

Address

City..... State.....



It's the Nash!

The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

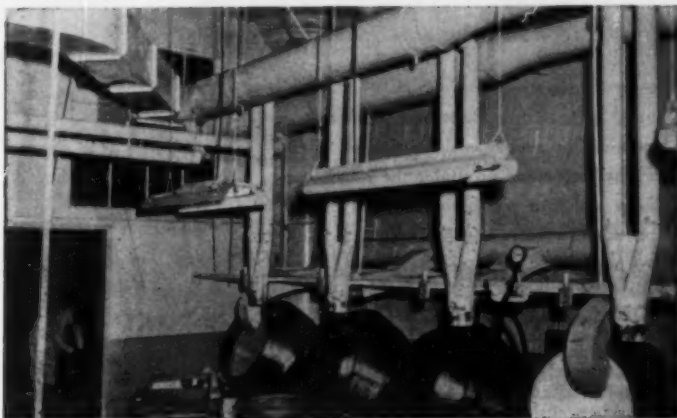
Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

No internal wearing parts.
No valves, pistons, or vanes.
No internal lubrication.
Low maintenance cost.
Saves floor space.
Desired delivery temperature
Automatically maintained.
Slugs of liquid entering pump
will do no harm.
75 pounds in a single stage.

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.



Out-of-the-way like a trunk in the attic-- Lectrodryer keeps the "downstairs" DRY



Processing floor space at a premium? Put a Lectrodryer in less valuable space, and DRY air in storerooms, processing and packaging rooms, summer or the year 'round.

Lectrodryers control the WETth you can't see, but whose results show up in damp stores and slowed-up processing—control it dependably,

at minimum operating cost and minimum maintenance. To get the facts on how other manufacturers have solved their WETth problems, write for your free copy of "Because Moisture Isn't Pink". Pittsburgh Lectrodryer Corporation, 305 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Drier, Limited, Tyburn Road, Edlington, Birmingham.
In Australia: Drier, Limited, 51 Parramatta Road, Glenside, Sydney.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: E. A. Belge Stein et Roubaix, 320 Rue de Meudin, Brussels-Linga.

**LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS**

LECTRODRYER

REGISTERED TRADEMARK U. S. PAT. OFF.



HERCULES CARBOY BOXES

GIVE YOU **EXTRA
PROTECTION!**

PROMPT DELIVERY

You get extra protection from these rugged, all wood carboy boxes due to their sturdy, patented construction . . . with interchangeable cork (Hercules) or rubber cushion (Aero) inserts and cushions. That's why they stand up under the rough-and-tumble of regular usage and save you both time and money by reducing bottle breakage, repairs and replacements. For the best carboy boxes possible . . . contact National!

6½-GALLON CARBOY FEATURES

Built to withstand an internal pressure of 10 lbs. this completely enclosed wooden carboy, with interchangeable cork or rubber cushion inserts and cushions, complies with I.C.C. 1-D regulations for the transportation of mineral acids. Specific application should be made for other uses.

1. Flat cover—no protruding neck—enables boxes to be piled on top of each other for convenient, compact storage.
2. Corner posts provide a convenient handle so that one man can handle the carboy.
3. Small size and light weight provides for easier handling and shipping.
4. Regulation Polystyrene cap supplied.

Complies with
classification I.C.C. 1-D



For Information write to Dept. E



13-GALLON CARBOY FEATURES

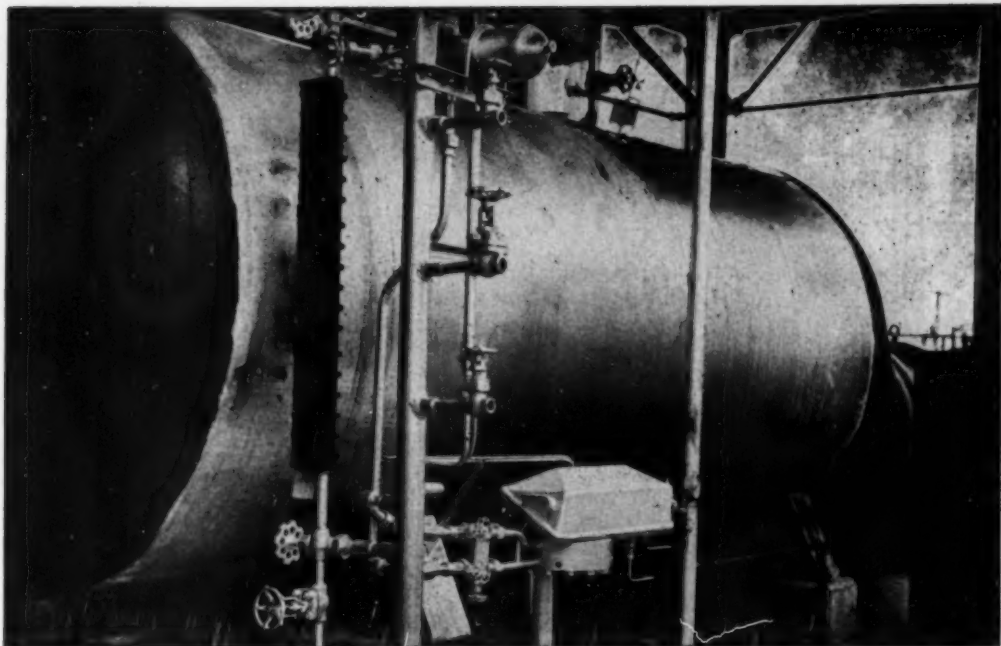
1. All-point protection reduces bottle breakage to a minimum—both in loading and transit.
2. Reduces occupational hazards since safety from breakage minimizes danger of acid burns or fire.
3. Eliminates foreign filler materials from container.
4. Easy to handle, through good grip on side hand braces.
5. Compact loading, resulting in space saving storage.
6. No skilled labor or special tools required. Any man can handle it quickly and efficiently.
7. Also available in 5 gallon and other capacities.

Complies with classification
I.C.C. 1-A

NATIONAL BOX & LUMBER COMPANY

NEWARK 5, NEW JERSEY





Republic Transmitter measuring level in reboiler

DIFFERENT... in design and performance

The Republic Pneumatic Transmitter is a device for converting process variables, such as flow, level, pressure or liquid density, into air pressures. These air pressures are a direct measure of the process variables or can be used as the measuring impulse for the actuation of an automatic controller.

The force-balance method of measurement, as employed by the Republic Pneumatic Transmitter, offers many inherent advantages such as:

AMBIENT TEMPERATURE—The effect of ambient temperature variations on the accuracy of a Republic Transmitter is negligible. Since all parts are equally affected by temperature changes, force and leverage relationships are not disturbed and accuracy is unimpaired.

AIR SUPPLY PRESSURE—The effects of changes in air supply pressure is so small that it is guaranteed negligible.

LINE PRESSURE—The effect of variations in line pressure has been completely eliminated.

SENSITIVITY—Due to the negligible motions required for complete operation of all parts for full scale changes, no appreciable hysteresis results from reversal of direction of measurement change. The hysteresis loop is so small that it is undetectable by ordinary means, being less than 1/20 of 1%.

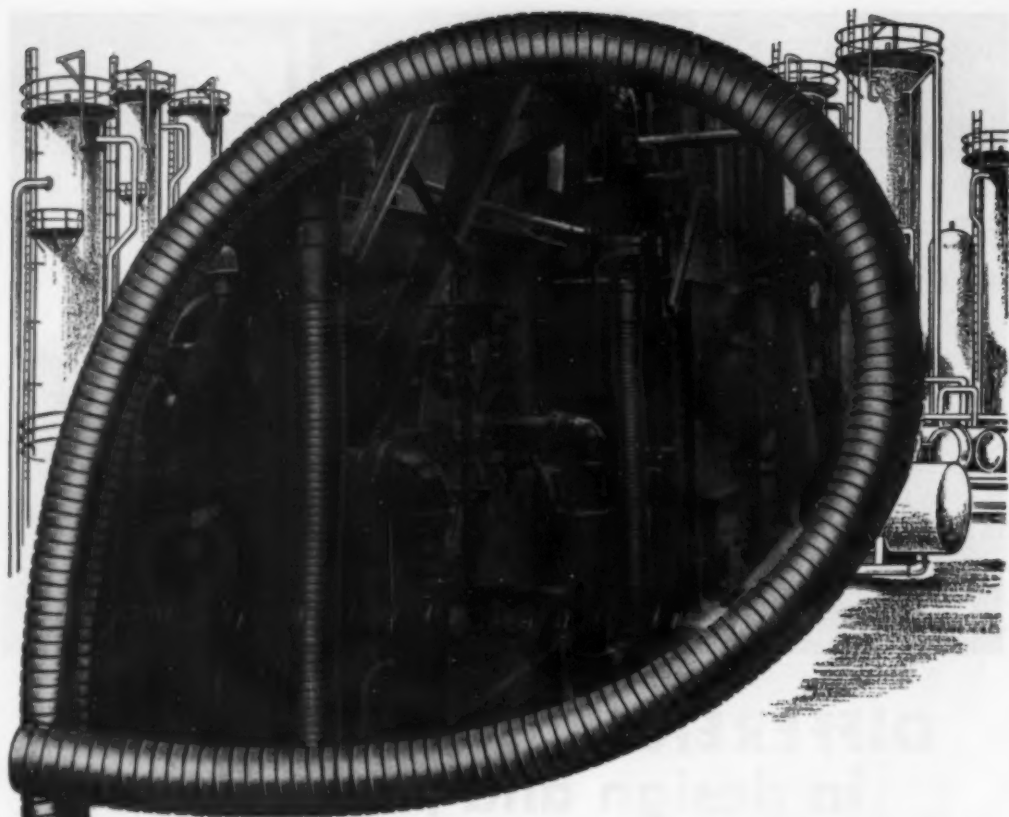
ACCURACY—The accuracy of the Republic force-balance method of measurement is higher than can be consistently secured and maintained with any other method. Transmitting pressure vs. measured force is guaranteed within 1/2 of 1% of meter range.

In addition to these five important features, the Republic Pneumatic Transmitter is extremely flexible in application, easy to service and of rugged construction.

If you have a flow, level, pressure or liquid density metering or control problem may we suggest that you investigate the Republic Pneumatic Transmitter? Data Book No. 1002, which contains complete details of this instrument, will be mailed to you upon request. Write for it today!

REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois



CORRUGATED "MUSCLES" THAT LET PIPES MOVE

PENFLEX METAL HOSE ABSORBS THERMAL EXPANSION . . . PREVENTS JOINT LEAKS

Petroleum still burners like this one in Kermit, Texas, put heavy strains on piping. Thermal expansion, contraction and physical shock make safe sealing of burner pipe joint assemblies a vital requirement.

Penflex flexible metal hose with couplings is used on these burners to absorb any pipe movement due to extreme temperature and pressure changes. Lengths of 4' I.D. interlocking, four-wall galvanized steel hose are installed

on each burner. Provides outstanding safety and high, uninterrupted flow of volatile fluids. Leak-proof, tough and flexible.

Penflex engineers can help you solve flexible tubing application problems. Penflex manufactures a complete line of four-wall, interlocking and seamless welded corrugated tubing . . . from $\frac{1}{4}$ " I.D. and up . . . automatic barrel fillers, accessories and fittings. Write for illustrated folder, "Flexineering," containing valuable flexible tubing data for your product application.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Phila. 42, Pa.
Branch Sales Offices: Boston • New York • Chicago • Houston • Cleveland • Los Angeles

penflex
HEART OF INDUSTRY'S LIFE LINES



Are you a plans man?



...or a process man?



Whichever you are, it pays to make full use of **NATIONAL service on LEAD EQUIPMENT**

Whether you're in planning or production...you can save yourself time and expense by using NATIONAL service on lead equipment in any form: separators, agitators, all types of tanks and vessels.

By using NATIONAL service, you make sure of two important things...

You make sure your equipment is properly *designed*. NATIONAL's Engineering Department has specialized for many years in the development of acid-handling equipment for numerous branches of the chemical field.

You make sure your equipment is properly *fabricated*. NATIONAL's "Homogeneous" process of bonding lead to steel gives you positive

assurance that the lead lining won't creep, buckle, or lose its grip. As the leader in lead, NATIONAL knows the problems involved in building all types of processing equipment to specifications...and has the know-how needed to solve these problems.

When you need lead-lined or lead-covered equipment for handling corrosive chemicals...when you need any other lead product...be sure to take full advantage of NATIONAL service.

NATIONAL LEAD COMPANY

New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Co. of Mass.); Los Angeles 23 (Morris P. Kirk & Son, Inc.); Toronto, Canada (Canada Metal Company, Limited)





New

STAINLESS STEEL CHEMICAL CONTAINERS

by

Hackney
MILWAUKEE

Ideal for shipping and storing
nitric acid, phosphoric acid, solvents
extracts, fruit juices, oils
and many other products

LOWER COSTS

Shippers of chemical products can now enjoy important savings—thanks to a new Hackney Stainless Steel Chemical Container. Compact and lightweight, this 15-gallon barrel can be handled easily by one man, reducing handling costs. What's more, further savings are possible because of the lower transportation costs, reduction in storage space and elimination of breakage.

EASILY CARRIED

Rugged, full curled separate foot ring construction provides easy, quick and sure handling. Empty or full, Hackney Acid Barrel can be readily grasped and handled by handy ring.

EASILY IDENTIFIED

Ownership of Hackney barrel clearly indicated by easily read letters in bottom foot ring. Prominent display of owner's name and address also serves

as a permanent advertising medium. ICC data embossed in top ring.



POUR SAFELY

No hazards of slipping, dropping or spilling strong, dangerous acids! That's because of the safe, positive grip assured by the curled foot rings.



STACK PERFECTLY

Hackney Acid Barrels are designed for positive stacking. Bottom foot ring fits snugly and securely over top ring of next barrel. Barrels cannot fall from this compact stack. Hackney Acid Barrels are offered in various

types dependent on intended use. Write today for full details.



PRESSED STEEL TANK COMPANY

Manufacturer of Hackney Products

1447 S. 66th St., Milwaukee 14

203 Hanna Bldg., Cleveland 15

308 S. LaSalle St., Room 792, Chicago 4

1325 Vanderbilt Concourse Bldg., New York 17

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CONTAINERS FOR GASES, LIQUIDS AND SOLIDS



Give your Republic Distributor half a chance and he'll lick your toughest problem in the application of industrial rubber products. Call him today for a free analysis!

TEXAS PEANUT COMPANY SAYS IT PAYS TO..

Try Republic First

Texas oil doesn't all come from wells. Folks down thataway raise more than 300 million pounds of peanuts every year and there's a lot of oil in peanuts. So much, in fact, that ordinary conveyor belts can't even haul *unbelled* peanuts without serious damage. The belt covers swell up... become sticky masses of gum that leave the carcass completely unprotected from abrasion and mildew.

Republic Rubber Conveyor Belting, made of oil-resisting Reprene, is the answer. Since switching to Republic, the Texas Peanut Company, Commanche, Texas, has had two seasons of uninterrupted service from their conveyor belt, which they say, "... shows absolutely no signs of wear!"

If your work has anything to do with oil contact of any kind, we suggest you quickly get in touch with Republic or your Republic Distributor. He sells a complete line of oil-resisting hose, conveyor belt, transmission belt... everything in industrial rubber products and, believe us, it pays to try Republic First!

INDUSTRIAL RUBBER PRODUCTS BY
REPUBLIC RUBBER DIVISION

Lee Rubber & Tire Corporation
YOUNGSTOWN, OHIO



CONVEYOR BELT MAINTENANCE TIP

Your conveyor belt will give longer service when the load is equalized across its width. Keep your belt running straight and maintain uniform loading.



← R-S valvEvents →

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



RUGGED Simplicity

Correctly engineered mechanically and metallurgically, all body assemblies of R-S Valves equal or exceed A. S. A. standards in every detail. These valves are designed and constructed for rugged service and provided with such safety factors that they will exceed service expectations as well as reduce pumping and blower costs.

Consider also the few working parts, greater control rangeability, the self-cleaning feature and the fact that R-S Valves are readily adapted to automatic operation. Know the rugged simplicity of R-S Valves, and get the most from your valve investment.

District offices are listed in telephone directories as, "R-S Products Corp'n Valves".

R-S PRODUCTS CORPORATION
4600 Germantown Avenue, Philadelphia 44, Pa.

An S. Morgan Smith Company Subsidiary



No. 752—Heavy Duty Rubber Seated Wafer Type Valve with 5" angle seated vane and enclosed gear reduction drive. Gland can be removed and stuffing box repacked without removing prime mover.



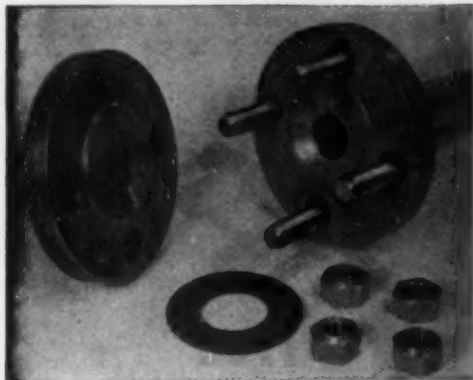
No. 739-740—Sixty-inch, 50-pound Heavy Duty Valve with gear reduction drive and handwheel for handling water at 40 psig. Vertical valve stem enclosed in steel pipe support. Thrust bearing absorbs vertical load.



No. 730—R-S Heavy Duty Floor Stand for rugged service in connection with any standard R-S hand-wheel operated valve.



No. 767—A 3-Way Valve (Two 24-inch 125-pound Cast Iron Valves bolted to 125-pound American Standard Tee). Electric motor operated by cross linkage. Automatic clutching handwheel for emergency operation.

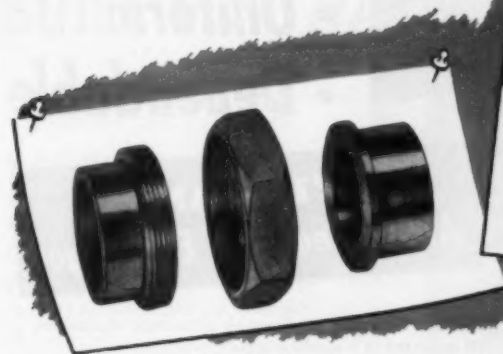
NEW*Speedline* fittings**OFFER SAVINGS on****CORROSION-RESISTANT PIPING JOBS**

*Speedline Insert Flange** with a corrosion-resistant serrated insert used in a carbon steel flange. Installation time is reduced. The only tools required for fixing this flange are an expanding tool and a plain wrench.

The three main advantages you can get with the new *Speedline* fittings are:

- 1.** Improved piping layouts with greater flexibility and increased capacity through the use of light-weight Schedule 5 pipe.
- 2.** Reduced installation costs because of simplified construction that frequently eliminates welding, vanstoning or threading of tubing or pipe.
- 3.** Lower first cost when compared with similar fittings available today.

To discover how *Speedline* corrosion-resistant fittings can simplify installation and help you conserve critical materials, write for a copy of the *Speedline Fittings Book*.



*Speedline Tube Union** combines the best features of screwed pipe unions and sanitary tube unions. It solves leakage problems frequently encountered with corrosion-resistant ground joints.

*Patent applied for



*Speedline Aligning Connector** can join Schedule 40 pipe (left) with light-wall Schedule 5 corrosion-resistant pipe. Or, used in complete installations of Schedule 5 pipe and lightweight O.D. tubing, it provides outstanding economy.

The *Speedline* Fittings described here as well as tees, elbows, etc. are made in A.I.S.I. grades of stainless and Carpenter Stainless No. 20. Other corrosion-resistant materials are used to meet specific conditions of service.



Sizes, Dimensions and Cost Comparison Data are in this 8-page *Speedline Fittings Book*. A table of pipe Schedules 5, 10, 40 and tubing cross-sectional areas gives useful information for planning piping layouts. Write for your copy today.

HORACE T. POTTS CO. Since 1815

Erie Avenue and D Street, Philadelphia 34, Pa.
GA 6-4600

Baltimore Branch Warehouse 2835 Sison St.
HOPKINS 6800

*Speedline***Corrosion-Resistant FITTINGS**

—the newest thing in pipeline economy

AIR

**AIR...the only cooling and
condensing medium that's...**



Fin-Fan Exchanger installed within a building

- **Free**
- **Limitless**
- **Uniform**
- **Dependable**

FIN-FAN **Air-Cooled Heat Exchanger**

Every plant designer, construction engineer and maintenance man knows the expenses, complications, and difficulties of water-cooled heat exchangers . . . the required piping, pumping, treatment and disposal . . . the likelihood of corrosion, scaling and freeze-ups . . . the uncertainty of sustained adequate supply.

All these problems are being avoided by plants in every section of the country which use AIR as the cooling or condensing medium . . . in FIN-FAN Air Blast Exchangers.

These exchangers, developed jointly by The Griscom-Russell Co. and Fluor Corp. Ltd., are self-contained package-type units. They include G-R K-Fin Heat

Transfer Sections with Fluor air circulation equipment, all mounted in a sturdy compact structure.

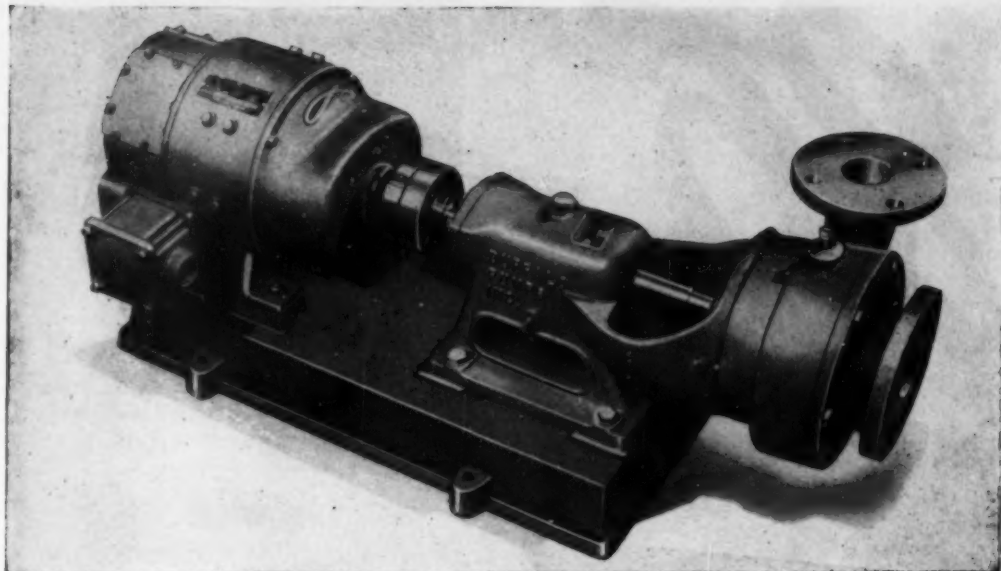
You can use Fin-Fan Exchangers on practically any cooling or condensing service. You can put them anywhere . . . on the ground, on a roof, or within a building. You can use a single installation for two or more heat transfer duties.

And these are only some of the many Fin-Fan benefits and advantages. Get the whole story of this important development in heat transfer apparatus . . . write for bulletin and ask for specific recommendations on Fin-Fan for your cooling and condensing needs.

THE GRISCOM-RUSSELL CO. 285 MADISON AVENUE, NEW YORK 17, N.Y.

GRISCOM-RUSSELL



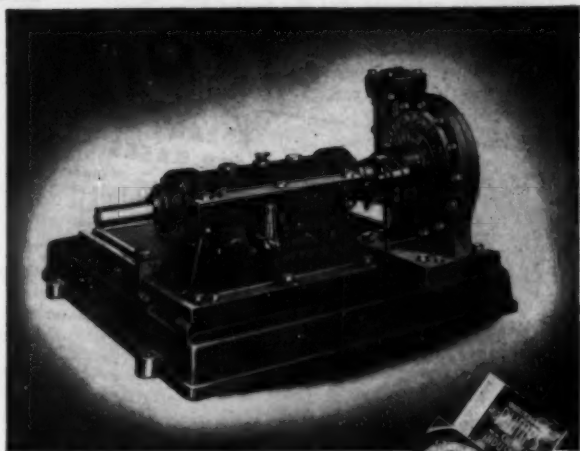


"Buffalo" Full Ball Bearing Single Suction Pump

BUILT FOR HARD CHEMICAL SERVICE

- Overall strength for high impeller speeds and casing pressures
- Available in special alloys for the chemicals you handle.

From every point of view, these "Buffalo" Chemical Pumps are a good buy. Their overall rugged construction means long life. Their enclosed type impellers are inherently high in efficiency, yet not subject to wear from close running tolerances. Ball bearings mean smooth operation. Stuffing boxes on the "Buffalo" Lead-acid Pump at right are not less than 3" deep; those of the pump above, not less than 2" deep. For best results on any chemical liquid, specify "Buffalo" and be sure!



"Buffalo" Lead-Acid Pump

WRITE FOR BULLETIN 982 on the complete line of "Buffalo" Chemical Pumps; and Bulletin 976-D on Full Ball Bearing Pumps.

PUMPS

"Buffalo"

BUFFALO PUMPS INC.

501 BROADWAY,

BUFFALO, NEW YORK

Canada Pumps Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

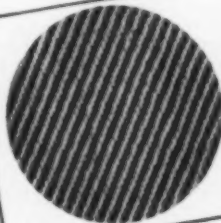
25 GOOD REASONS

WHY INDUSTRY DEPENDS ON SPERRY FOR FILTRATION

The plate filter press, the filtration method pioneered by Sperry is the most widely used filter in industry today. The inherent advantages of this type of filter explain its wide usage.

Consider these advantages as applied to your own operation. Compare the flexibility, low first cost, low operating cost of a Sperry Filter Press with any other type of filter on the market.

For more specific data as to your own filtration problem consult Sperry. Send samples of your material for a test run.



SPERRY FILTER BASES

Sperry offers a full range of filter bases. All types and sizes. Plain or punched to your specifications. In addition to cotton and paper, bases are furnished in wool, synthetics, glass and woven metals. Consult Sperry for special bases to meet unusual requirements.

D. R. SPERRY & COMPANY

BATAVIA, ILLINOIS

Filtration Engineers for over 50 years

Eastern Sales Representative: H. E. Jacoby, M. E.

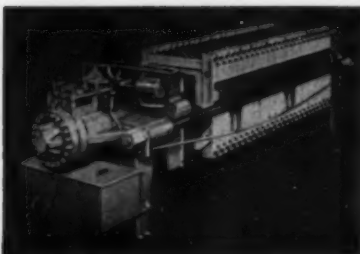
205 E. 42nd St., New York 17, N. Y.; Phone MUrray Hill 4-3581

Western Sales Representative: B. M. Pilshaky

833 Merchants Exchange Bldg., San Francisco 4, Calif.

Phone DO 2-0373

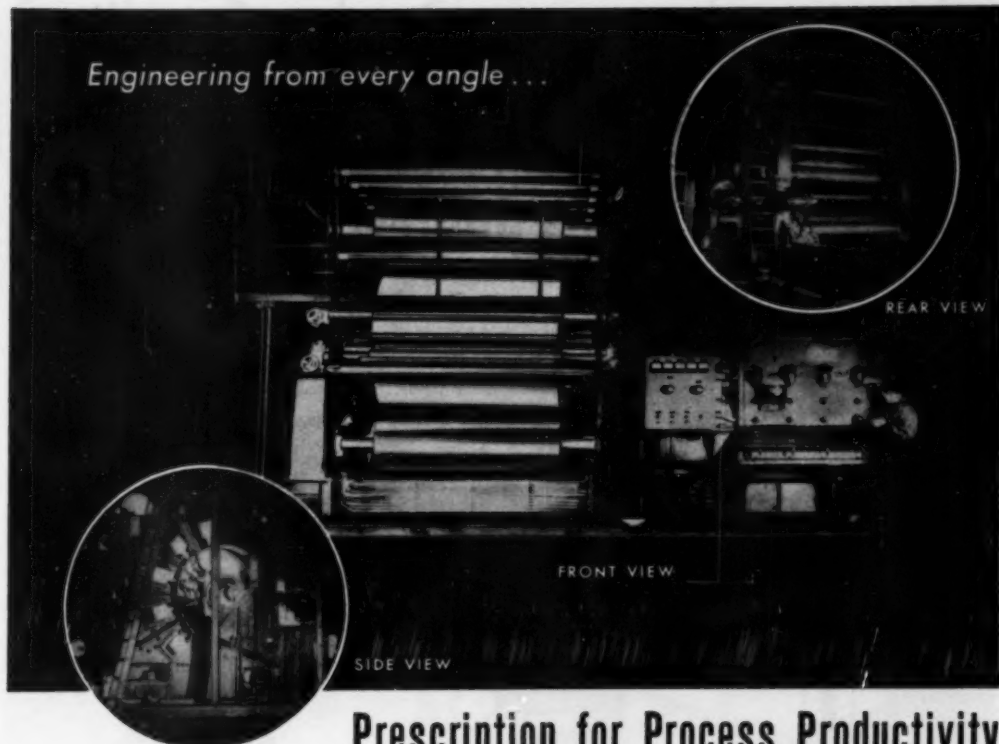
SPERRY FILTER PRESSES



THE SPERRY FILTER PRESS:

1. Will handle any kind of filterable mixture, including viscous substances.
2. Produces maximum clarity.
3. Produces the driest cake.
4. Can deliver cake in slab form suitable to place in drier trays.
5. Thoroughly washes the cake.
6. Uses the simplest kind of filter cloths. (Can use cloth cut direct from roll.)
7. Cloths are easily removed and replaced.
8. Can use filter paper or pulp.
9. Can be used with precise temperature control.
10. Can handle hot liquors without vaporizing.
11. Is easily made of acid or alkali resistant material.
12. Low first cost.
13. Low cost of labor.
14. Least floor space and head room required.
15. Weight per square foot no greater than other types.
16. Low depreciation.
17. Can perform low, medium, or high pressure filtration.
18. Easily resold. (On account of its wide use.)
19. Can filter without exposing the liquid to the atmosphere.
20. Can be used to separate emulsions.
21. Easily erected by unskilled labor.
22. Can be transported in small pieces.
23. Will deliver filtrate to higher level than filter.
24. Can use wire, wool, asbestos, glass, vinylon, and many other kinds of filter cloths.
25. Can be furnished in leak-proof construction.

Engineering from every angle . . .



Prescription for Process Productivity ... Diagnosis by Lukenweld

Like walnuts, a process problem has to be opened up on all sides to really get at the meat.

Here's a story of one processor who enjoyed a 50% cut in down-time through Lukenweld's penetrating study of his equipment problem. Typical of Lukenweld's thorough going exploration of every process need, this story suggests the kind of job-diagnosis that spells plus performance for your operation.

A prominent manufacturer needed equipment for continuous high-speed bonding of raw linoleum and felt backing. Big bottleneck — costly maintenance, expensive down-time.

Answering the challenge, Lukenweld designed and built a new Rotary Press Machine. All parts were made readily accessible, lopping off days of time-

consuming maintenance...resulting in at least a 50% reduction in down-time. Individual drives on belt and cylinder, enabling operation with reduced belt tension, assure longer belt life, fewer costly replacements.

The machine has mobility to facilitate economical servicing of several curing ovens, saving time. Further production savings are forecast when preliminary operations can be mechanized to take fuller advantage of design efficiency. A quality product is insured through an efficient combination of heat and pressure.

Whether your needs are for similar equipment or other process machinery, Lukenweld can help solve your processing problems. Write — Lukenweld, Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

SPEED SALE OF YOUR SCRAP

Improved machinery for improved processes through engineering

LUKENWELD

A DIVISION OF LUKENS STEEL COMPANY



Remember! There's a Powell Valve to handle EVERY kind of CORROSIVE MEDIA



Fig. 1847—Small 200-pound Swing Check Valve with screwed in cap and regrindable, renewable disc. Available in a wide variety of corrosion-resisting metals and alloys.

We could never know *your* business as well as you do. But do you know what materials should go into a *valve* to resist the action of Hydrochloric Acid—Caustic Soda—Nitric Acid—Phenol—Sulphuric Acid—Black Liquor—to pick at random a few of the countless corrosive media handled in the Chemical and Process Industries?

We do, because that's *our* business. And what's more, Powell—and only Powell—makes valves of the correct materials to handle them all. Just tell us the media—we'll furnish the *right* valve to resist its corrosive action.



Fig. 1891—Liquid Level Gauge with flanged end O. S. & Y. valves. Off-set pattern.

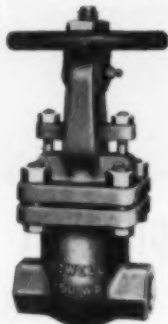


Fig. 2490—150-pound O. S. & Y. Gate Valve with screwed ends. Supplied with precision fitted, quickly interchangeable solid or split wedges. Stem is threaded and guided through a revolving bushing, screwed into upper yoke which has a compression lubricant fitting. Available in a wide variety of corrosion-resisting metals and alloys, with bolts and nuts in Stainless Steel. Also made with flanged ends.

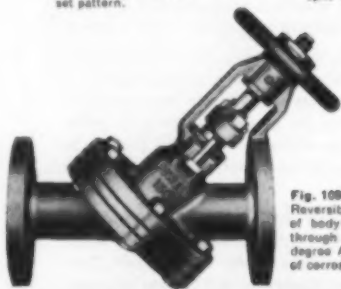
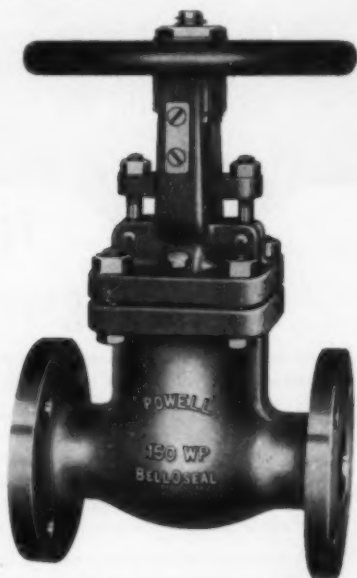


Fig. 1097—150-pound Separable Body, Reversible Seat 'Y' Valve. Lower half of body can be unbolted and turned through arc of 180 degrees to make 90 degree Angle Valve. Made in a variety of corrosion-resisting metals and alloys.

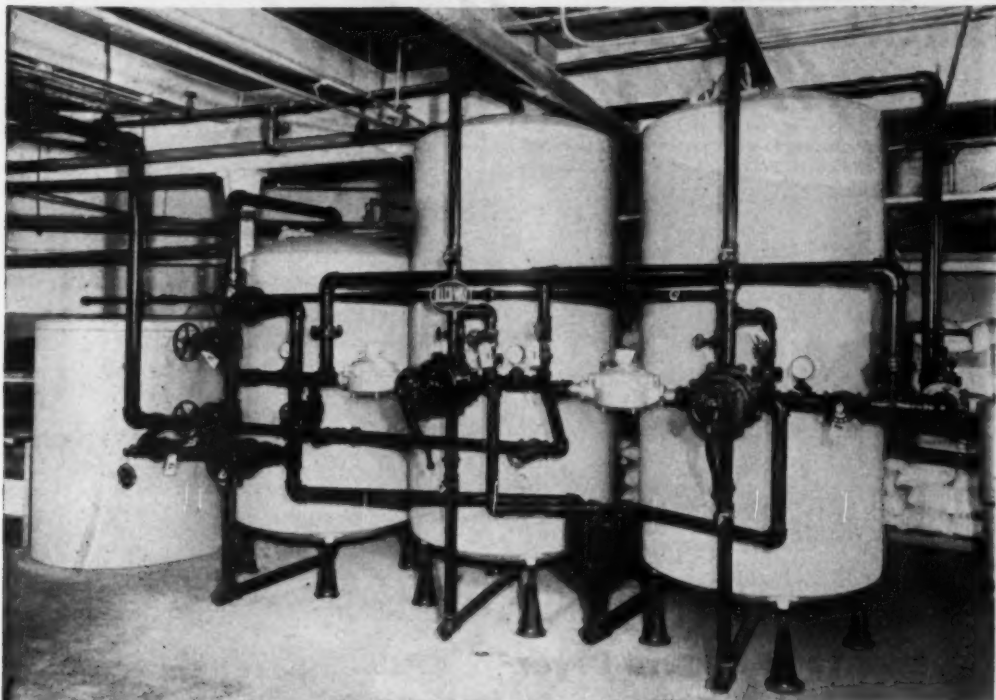


Belt-O-Seal Globe Valve. Designed to handle hazardous fluids; for high vacuum service; or for use wherever a packless valve is needed. Available in Globe, Angle and 'Y' patterns, with screwed, flanged, or welding ends. Can be furnished in a variety of corrosion-resisting metals and alloys, in sizes from 1/4" to 12", inclusive.

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

Centlivre Brewing Corp. gets soft water plus ...with Illco-Way engineering and equipment



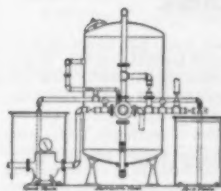
Duplex ILLCO-WAY Softeners and filter at Centlivre Brewing Corp., Fort Wayne, provide 100 gpm of soft water with controlled characteristics to eliminate corrosion

Centlivre Brewing Corp., Fort Wayne, Indiana, distributes water for its cooling system and for bottle washing through the same lines. ILLCO-WAY technicians recommended the installation shown above—equipment to soften a part of the water and blend it with filtered raw water.

Result: a final treated water that is non-corrosive and non-scale-forming in the cooling system—and sufficiently soft for washing bottles. (Raw water supply has 25 grains of hardness.)

Centlivre's use of ILLCO-treated water eliminates costly shut-downs due to scaling in bottle-washing and cooling equipment. Bottles are free from stain; and there is a notable reduction in the amount of soaps and detergents required. Management has expressed itself as being "very gratified with the efficiency of the equipment and results obtained."

Write for complete literature on general water problems, boiler feed problems, and the like.



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See data in Sweet's File, Engineering

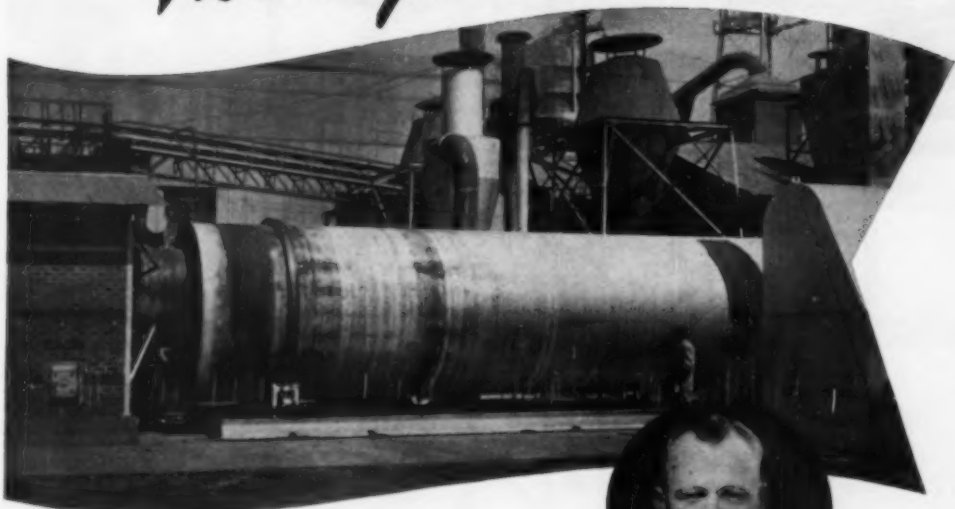


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... "works fine,"
says Sunkist's James A. Finley, Exchange Orange Products Co. manager, with regard to the new Standard-Hersey Dryer in the Company's Ontario, California plant. Those two short words from a speak conscious expert high productive efficiency of the Standard-Hersey drying equipment, which consists of furnace house, dryer unit, two cyclones and a dust collector.



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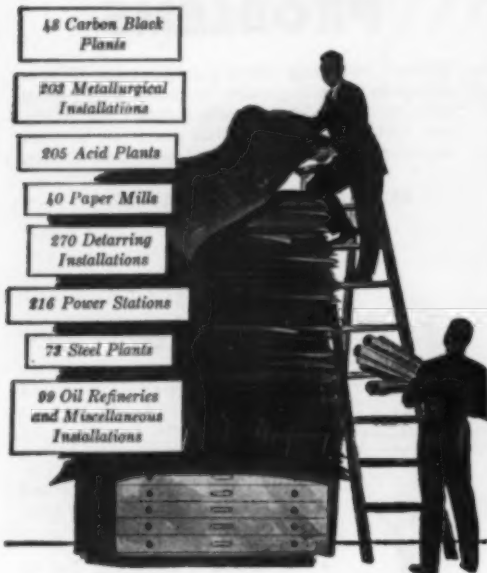
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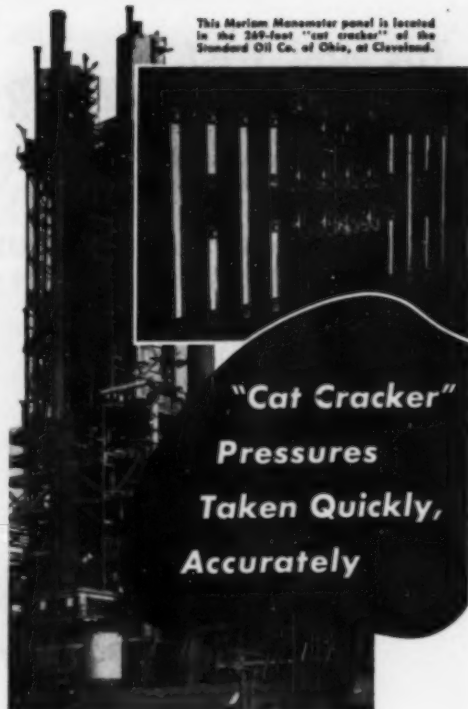
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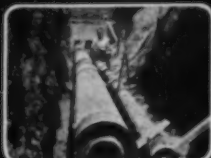
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CHEMICAL ENGINEERING—July 1951



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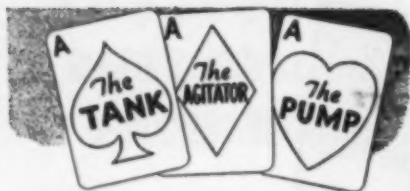
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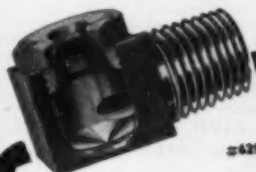
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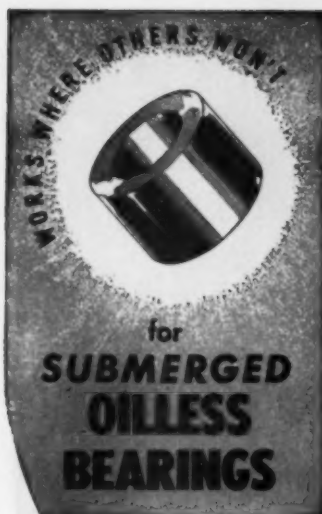
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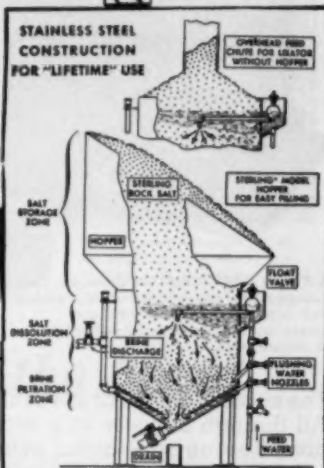
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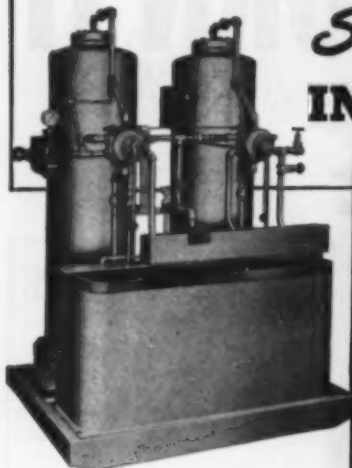
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INTERNATIONAL SALT COMPANY, INC., Scranton, Pa.

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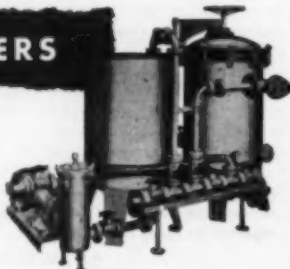
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For Solution Clarification Any Solution—Any Quantity

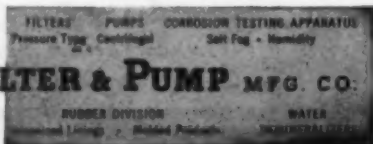
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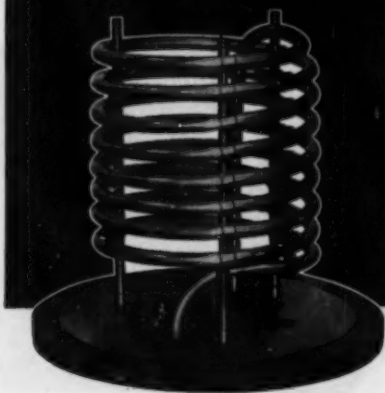
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CHEMICAL ENGINEERING—July 1951

It can cost so little....

TANTALUM

Heat Transfer Equipment



Above: Tantalum bayonet heater,
the simplest form of heater. Left:
Tantalum steam coil for rapid heat-
ing of contents of agitated kettle.

.....to have the best!

Case history after case history testify to the fact that Tantalum heat exchangers not only effect savings which pay for the equipment in very short periods of time but, in the long run, give economies in maintenance which appear as big black profit figures.

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Fansteel engineers are at your service for consultation on any corrosion or heat transfer problem where the metal tantalum can be economically used to your best advantage. Fansteel Metallurgical Corporation, North Chicago, Illinois, U.S.A.

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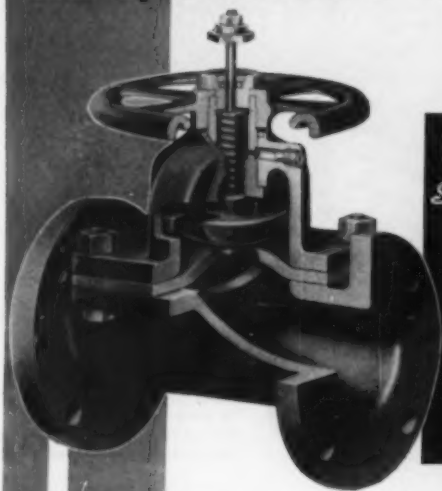
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Saunders Patent
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VALVE
with L-1
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DIAPHRAGM

Sulphuric acid up to 66° Bé can now be valved without leakage, dripping or sticking . . . with Hills-McCanna Diaphragm Valves equipped with the new L-1 plastic diaphragms. This new development combines the tried and proved Saunders Patent pinch clamp principle with a diaphragm of a special type of plastic that is particularly resistant to concentrated sulphuric acid.

Hills-McCanna Diaphragm Valves with L-1 diaphragms are suitable for temperatures up to 125° F. and pressures up to 100 psi. Sizes from 1/2" thru 4" are available, handwheel operated, quick opening (lever operated) and sliding stem models. Choice of nearly 50 body materials or linings including cast iron, cast steel, Darimet or glass lined.

Literature is available describing Hills-McCanna Valves with data on their use for acid and other services. Write for your copy outlining the nature of your application. HILLS-McCANN COMPANY, 2341 W. Nelson St., Chicago 18, Ill.

The valve illustrated in cut-away above is the Hills-McCanna Model #600 semi-sealed bonnet acid valve with L-1 plastic diaphragm and tell-tale travel stop indicator. Valves of this type can be furnished where particularly rigid safety precautions must be taken.

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with horns?



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Cambridge design engineers solved this problem by attaching metal spikes to a standard woven wire conveyor belt. Results: fewer fires because Monel metal spikes reduce sparking, no belt damage or repairs when fires do occur, water from sprinklers will not harm the belt, longer belt life from all-metal construction.

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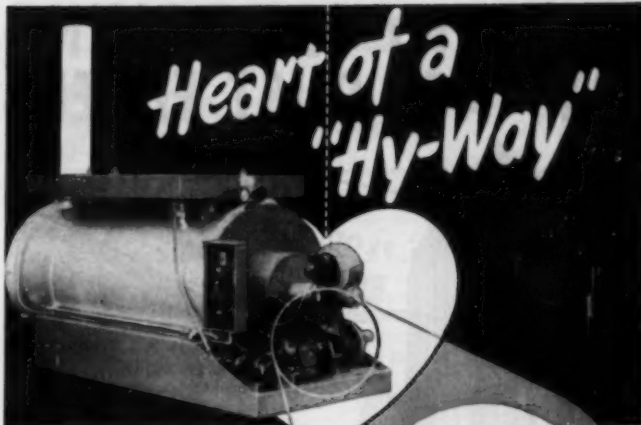
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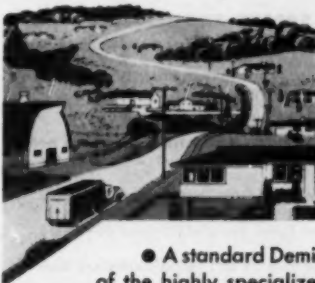
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Above view shows a "Hy-Way" Model 40-B Hot Oil Heater engineered and manufactured by Hy-Way Machinery, Inc., Youngstown, Ohio. This equipment is designed for mounting on a truck or trailer for use with portable asphalt plants employed in the construction of roads and streets.



Above view shows a Deming Fig. 4020 Side Suction Centrifugal Pump used to circulate hot oil in the "Hy-Way" Model 40-B Hot Oil Heater.

● A standard Deming Pump is the mechanical "heart" of the highly specialized equipment shown above. This pump circulates hot oil through dissipating coils, jackets, and radiators to maintain higher product temperatures than formerly obtainable with steam heat exchange equipment.

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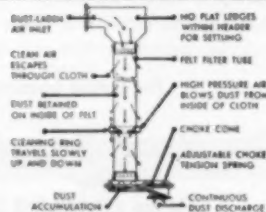
The soundness of the Day Type "AC" Dust Filter principle, effecting outstanding efficiency of operation with minimum maintenance, is verified by industry itself. 87% of our production of Day Type "AC" Dust Filters is channeled to meet the demands of users who are witnessing the results in their own plants—and reordering.

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- **CONTINUOUS-AUTOMATIC OPERATION** . . . the use of slow traveling, reverse jet cleaning rings gives automatic-continuous operation without shutdowns for cleaning.
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- **NO DUST-CATCHING LEDGES** . . . DAY TYPE "AC" FILTERS, with a pattern of square-to-round inlet fittings, have no flat surfaces where dust can accumulate and become contaminated.
- **OUTSTANDING ADAPTABILITY** . . . units can be furnished with multiples of 4 tubes; housed or unhoused (see illustration); can be applied for either pressure or vacuum.

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The reverse air jet mechanism provides uniform cleaning over the entire length of the tubes, and operates with a maximum cloth area loss of only 1 1/4% at any time. Air volumes remain constant and there are no cleaning shutdowns to cause high back pressures and sharp air volume variations.



Write-to-DAY for Bulletin 491



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Technical Topics

ALLOY TYPE 25-12

Norman S. Mott

Chief Chemist and Metallurgist

Alloy type 25-12 (CA22) is mainly a heat resisting alloy, although in the low carbon grade, with or without columbium or molybdenum, it is often used for its corrosion resistance. It is the most economical alloy for high temperature structural applications, such as tube supports, dampers and general furnace parts. In gas carburizing and bright annealing or hardening atmospheres its resistance is excellent and its resistance to high temperature air oxidation and to the corrosive action of high sulfur fuel flue gases is outstanding.

The 25-12S, 25-12SCb and 25-12SMo grades give excellent service in the sulfite pulp industry; and offer high resistance to nitric, phosphoric, dilute sulfuric and hydrochloric acids, as well as to organic acids such as citric, tartaric and lactic. 25-12S has better corrosion resistance than 19-9S, with carbon not being so critical. This holds for use in dilute sulfuric and hydrochloric acids at all temperatures, and in nitric acid at all concentrations and temperatures. In fact, in the boiling 65% nitric acid test 25-12S as cast is as good as 19-9S in the water quenched condition. The addition of molybdenum makes this alloy remarkably resistant, and its superiority in hot dilute sulfuric and hydrochloric acids over 19-9SMo is considerable. This suggests its use over 19-9SMo in some of the more exacting applications not necessitating the use of expensive FA-20 type alloy.

A.S.T.M. Specification B190-45T classifies the 25-12 alloy into two categories according to magnetic permeability: Type I, having a range of 1.05-1.7, and Type II, having a maximum of 1.05, after holding for 24 hours at 2000° F and water quenching. Since strength and ductility vary inversely at high temperatures, Type I containing ductile ferrite is able to resist fracture due to sudden overloads by yielding slightly under these stresses, but it has relatively low creep strength. Type II is completely austenitic and has high creep strength under con-

ditions of constant loading, but is not as resistant to sudden shock.

Of major importance in heat applications is the influence of structure on its properties. The amount, form and distribution of the carbides affect strength and ductility and are determined by the percentage of carbon present in the alloy, the temperature, and the time of holding. Of perhaps greater importance is the presence of ferrite in the structure. While it enhances ductility at elevated temperatures after short-time aging, it must be discounted if the alloy is to be exposed for extended periods at the intermediate temperature range of 1200-1700° F, as this range favors the formation of a sigma phase which is hard and brittle. Its presence may result in reduced strength, ductility, and especially thermal fatigue cracking resistance. Thus there is much less tolerance for suddenly applied stress overloading or rapid temperature changes. Continued service about 1700° F. precludes this sigma formation.

To estimate ferrite on the basis of chemical analysis the Alloy Casting Institute suggests the following formula:

$$R.F. = \frac{[\% Cr + 3 (\% Si - 1)] - [\% C \times 16]}{\% Ni}$$

A ratio factor less than 1.7 denotes a negligible amount of ferrite or sigma and corresponds to the A.S.T.M. limit in permeability value of 1.05. A ratio factor of 1.7-1.85 denotes 2-7%, and a ratio factor above 1.85 denotes above 7% of ferrite or sigma.

Available on request

Cooper Alloy Materials Selection Chart—designed to help you choose the most economical alloy for any corrosive condition. This chart will save you money and save critical

materials for national defense. Address your requests to Publicity Dept., The Cooper Alloy Foundry Co., Hillside 5, N. J.

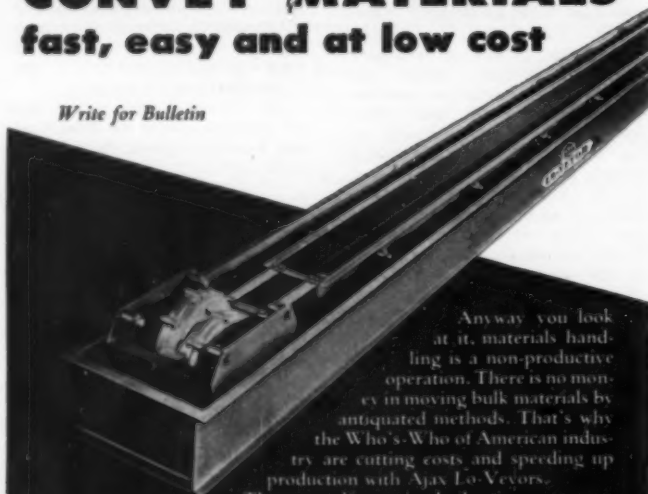


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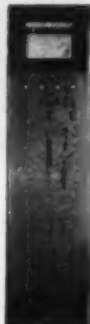
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CaO	0.009
MgO	0.005
L. O. I.	0.072
Total	100.023

Detailed information on Oklahoma's mineral resources is available on request, based on data by the Oklahoma Geological Survey. Map showing location of mineral deposits is also available.

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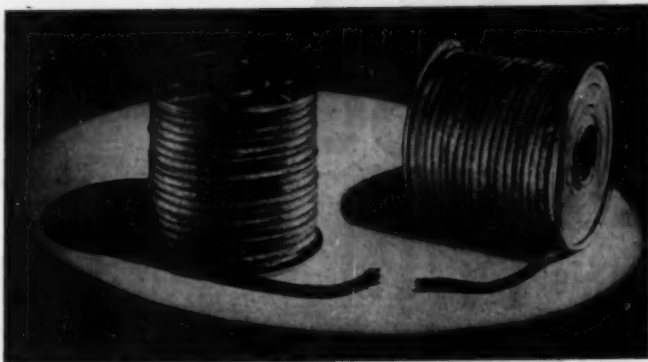
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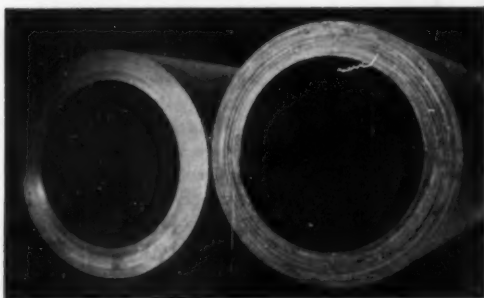
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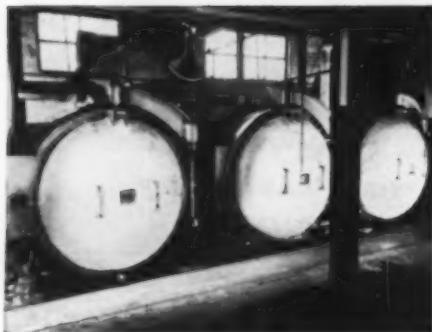
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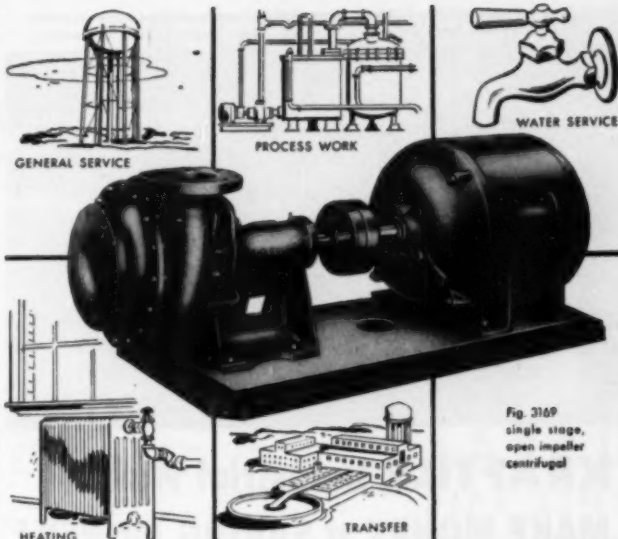
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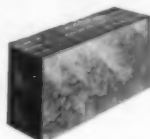
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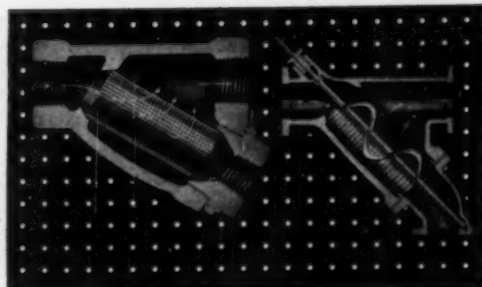
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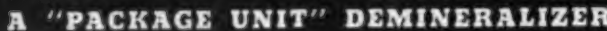
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Process Research and Engineering
Development
457 Washington Street, New York 13, N. Y.

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Research Chemists and Engineers
A staff of 75 including chemists, engineers, bac-
teriologists and medical personnel with 10 stories
of laboratory and a pilot plant are available for
the solution of your chemical and engineering
problems. Write today for Booklet No. 3
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RESEARCH AND DEVELOPMENT
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Processes—Products*
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Chemical Engineers
Design — Consultation — Complete Plants
sulfuric acid — phosphoric acid
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**FRASER-BRACE
ENGINEERING CO., INC.**
Design Engineers & Constructors
Hydro-electric Developments
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Chemical & Process Industries
Railroads — Tunnels — Port Facilities
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Consulting Chemical Engineer
DEVELOPMENTS — OPERATION
CARBOHYDRATE INDUSTRY —
BY-PRODUCTS
CARBON DIOXIDE — WASTE DISPOSAL
Parkard Building Philadelphia, Pa.

**THE J. G. WHITE
ENGINEERING CORPORATION**
Design • Construction • Reports • Appraisals
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Knowledge plus Experience . . . always a vital asset—

When you are in need of expert advice to be applied to solving your particular problems, save
TIME and COST by calling in a specialist.

These consultants have broad experience in management services that can be invaluable to you.

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RE SALE

UNDISPLAYED RATE:

\$1.20 a line, minimum 3 lines.
To figure advance payment count 5 average words as a line.

EMPLOYMENT WANTED—INDIVIDUAL SELLING OPPORTUNITY undisplayed advertising rate is one-half of above rate, payable in advance.

PROPOSALS, \$1.20 a line an insertion.

NEW ADVERTISEMENTS received by 10 A.M. July 25th at the New York Office, 330 W. 42nd St., New York 18, N. Y., will appear in the August issue subject to limitations of space available.

INFORMATION

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

DISPLAYED RATE:

The advertising rate is \$11.80 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page. C. E.

REPLIES (Box No.): Address in office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 180 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

(Additional Positions Vacant ads on pages 412 & 413)

TWO ENGINEERS experienced in chlorinations to take charge of constructing a new plant for the manufacture of insecticides. Excellent opportunity for right men. P-1841, Chemical Engineering.

YOUNG CHEMICAL engineer, well familiar with soda ash and paper and pulp plants design, urgently needed for well paid and extremely promising assignment. Please write with detail of experience to P-1148, Chemical Engineering.

WANTED: CHEMICAL engineer to train as administrative assistant to Works Manager. Heavy chemicals. Location—Baltimore. Salary commensurate with ability and experience. Write giving details of training and experience and salary requirements. P-1016, Chemical Engineering.

SALES MANAGER for food industry division of large industrial instrument manufacturer. Must have engineering background and comprehensive experience either in food processing or in the sale of process equipment to the food industry. Work involves directing sales and promotional activities with some field contact of major equipment manufacturers and food processors. Salaried position. Location Philadelphia. Replies will be considered confidential and should include complete resume of personal qualifications, work experience, and salary expected. P-1358, Chemical Engineering.

SELLING OPPORTUNITY OFFERED

SALES AGENT for Chicago territory. Old established well known manufacturer of crushing, grinding and air separating machinery requires sales agent for Chicago and surrounding territory. Give full details first letter. RW-1255, Chemical Engineering.

EMPLOYMENT SERVICES

SALARIED POSITIONS \$2,500 to \$35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Kirby, Inc., 269 Duane Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL \$2,000-\$25,000. This confidential service established 1937, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. B, 341 Orange St., New Haven, Conn.

POSITIONS WANTED

CHEMICAL ENGINEER. Four years experience includes pilot plant process and equipment development and operation. Specifications and project engineering or process equipment. Free to travel. FW-1196, Chemical Engineering.

CHEMICAL ENGINEER group leader: process engineering, design, development and plant design. 7 yrs. experience; AEC project operations, dairy by-product development. PW-1107, Chemical Engineering.

MECHANICAL ENGINEER—Maintenance Specialist—15 years exp. with chemical and pharmaceutical process equipment. Prepared to assume complete responsibility for entire plant maintenance program, with special emphasis on overall cost reduction. PW-1293, Chemical Engineering.

WANTED

HYDRAULIC SALES ENGINEER

Opportunity to earn \$15,000.00 first year salary and commission. Must have at least five years' sales experience New York Industrial Market and ability to head pump division of well established machinery concern. Unless you have initiative and are a "go getter" please do not reply.

SW-1163, Chemical Engineering
330 W. 42 St., New York 18, N. Y.

CHEMICAL SALESMAN

Technical background necessary. Experience in ion exchange process desirable. Some travel. Salary and expenses.

SW-1181, Chemical Engineering
330 W. 42 St., New York 18, N. Y.

CONSTRUCTION SUPT & ENGINEER

Technical college graduates well-exp'd in building construction & installation of equipment; willing to travel to locations in United States. State age, salary expected, experience in detail and data available to begin work.

Write box CE 296,
221 W. 41 St., New York 18, N. Y.

ENGINEERS

CHEM. ENGR. dep. to head up rubber
young men
CHEM. ENGR. plays
METALLURGISTS "aluminum"
"Gany Jr. position"

Call, write or wire: GLADYS HUNTING
DRAKE PERSONNEL
7 W. Madison St. Chicago 2, Ill.

POSITION WANTED

CHEMICAL ENGINEER: B. S. with seventeen years of experience (ether, solvent recovery, alcohol, urea, explosives, viscose rayon, and boiler water) in production, maintenance supervision and in research, development engineering seeks position in the Southwest. Qualified to handle any production operation. \$100 a week. FW-1395, Chemical Engineering.

SELLING OPPORTUNITY WANTED

SALES REPRESENTATION: Manufacturer's Agent, New York City, covering process industries in North East desires additional account. RA-1223, Chemical Engineering.

CONTRACT WORK

Custom grinding
Well-established company in New Jersey offers facilities for fine grinding of metallic and non-metallic to flake, chip and grain forms. Specialists in hazardous products. Packing, mixing and shipping facilities available. CW-1080, Chemical Engineering.

PATENTS

CONSULT: Z. H. POLACHEK.
Reg. Patent Attorney, 1334 Broadway, New York 1, N. Y.

AVAILABLE

CHEMICAL ENGINEER

Fourteen years' supervisory experience in production of four diversified plants, six years with present employer. Experienced in both batch and continuous operations, organic and inorganic, supervising as many as 475 operators, foremen, and supervisors. I have had outstanding success in increasing productivity by developing new production methods resulting in increased production per hour and per man hour of as high as 500% on major products. ALWAYS USING EXISTING EQUIPMENT WITHOUT ADDITIONAL CAPITAL EXPENDITURES. Developed one new product and performed excellent work in waste and by-product reduction and utilization. Gain has been in hundreds of thousands of dollars in short periods of time after working in a new plant.

Present salary is \$7,500 a year as Production Superintendent, and I am looking for a job which will duplicate my present salary and which will, in addition, provide compensation for outstanding improvements and developments, small stuff excluded. Supervisory position not mandatory. Age 38, married, will go anywhere.

FW-1187, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

EXECUTIVE CHEMICAL ENGINEER

with national reputation in chemical equipment and process design desires association with an organization seeking broader scope and diversification. Presently employed as an executive with a leading engineering company, he can supply the initiative and ideas to keep you selling tomorrow's products without intensive research and development. His age, in mid-thirties, and top flight experience represent an excellent long range investment to the firm facing uncertain growth and direction which can benefit from a creative spark.

FW-1116, Chemical Engineering
230 W. 42nd St., New York 18, N. Y.

CAPITAL TO INVEST

Engineer will purchase all or part interest in a substantial equipment or engineering company.

BO-1254, Chemical Engineering
230 W. 42 St., New York 18, N. Y.

Additional Business Opportunity and Wanted Advertising on page 412

*Opportunity***SUPERVISOR***engineering and development laboratory*

A POSITION is now available for a supervisor of an insulated electrical wire and cable laboratory—with large manufacturer in New Jersey.

Must have experience in design, development, manufacture and research on rubber, paper, plastic and varnished cambric power cables. Administrative and supervisory experience essential.

Write stating age, education, experience and salary desired.

ADDRESS

P-1205, Chemical Engineering
330 W. 42 St., New York 18, N. Y.

ENGINEERS**Process—Project
& Construction**

Refinery And Chemical
Engineering Co. Location
New York Area.
Please Send Complete Resume.

P-1081 Chemical Engineering
330 W. 42 St., New York 18, N. Y.

**INDUSTRIAL AND CHEMICAL
ENGINEERS**

Nationally Known, Medium Sized Manufacturing Company located in Chicago needs engineers who have had substantial experience in the development and manufacture of pressure sensitive industrial tape and adhesives.

Good starting salary and an opportunity to progress in the company. In your reply, please be as complete as possible about your education and experience.

P-1299, Chemical Engineering
330 W. 42 St., New York 18, N. Y.

Wanted**ELECTRICAL WIRE AND CABLE
DESIGN ENGINEERS**

IN NEW JERSEY—positions are now open with a large insulated wire and cable manufacturer for experienced engineers. They should have practical knowledge of rubber, plastic, paper and varnished cambric power cable manufacture, in addition to a thorough understanding of applicable specifications and design principles. Supervisory experience preferred.

Write stating age, education, experience and salary desired.

ADDRESS

P-1204, Chemical Engineering
330 W. 42 St., New York 18, N. Y.

**CHEMICAL PLANT
WANTED**

We are now manufacturing over \$20,000,000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained.

Address all replies

"Confidential" C. J. GALE, Sec.
233 Broadway, N. Y. 7, N. Y. BA 7-1919

AVAILABLE CUSTOM REFINING FACILITIES
• Distillation • Extractions
• Separations • Fractionations
Dram Lots—Tank Cars
WANTED
• All Types of Crude Mixtures
• By-Products, Residues, Wastes
• Contaminated Solvents

**TRULAND CHEMICAL
& ENGINEERING CO., INC.**
Box 426, Union, N. J. Unionville 2-7360

WANTED**Compressors Wanted**

STATIONARY - PORTABLE
LARGE OR SMALL

L. W. BAUER

22 Barnett Street Bloomfield, N. J.

BOUGHT SOLD
Glycols—Cellulosives—Ethanalamines
Phthalic—Maleic—Penta
Titaniums—Bichromates—Dyes—Colors
Soda Ash—Caustic Soda, etc.
CHEMICAL SERVICE CORP.
80-04 Bover St. New York 3, N. Y.

WANTED METAL-SCRAP

Buyers of

- Copper Scale • Copper Oxides
- Copper Catalyst • Copper Powders

OPELL METAL ASSOCIATES
4 E. 41 Street New York 17, N. Y.
Murray Hill 9-3421-2-3

WANTED

Large Capacity Stainless
KELLEY FILTER

BLOCKSON CHEMICAL COMPANY
Joliet, Illinois

EMPLOYMENT . . . EQUIPMENT . . .
BUSINESS

OPPORTUNITIES
Whatever your need—
think "SEARCHLIGHT" FIRST

CHEMICAL ENGINEER

Large Western New York synthetic organic chemical plant, noted for its high-quality manufacturing standards, has attractive permanent position for chemical engineer with 2 to 3 years' industrial experience on plant engineering projects. Liberal starting salary, with periodic review of performance for salary increases. Excellent working conditions, cafeteria, pension plan, plus group life, sickness and accident insurance. Reply in confidence to: Superintendent of Personnel Relations,

P-1825, Chemical Engineering
230 W. 42 St., New York 18, N. Y.

**CHEMIST OR
CHEMICAL ENGINEER:**

One of the leading chemical companies desires chemist or chemical engineer to do laboratory research on and use for new products developed in existing research department. At least 3 years experience essential in one or more of following products: waxes, paper coatings, polyethylenes and other plastics. Permanent position, good salary, liberal employment benefits. Give complete information in letter. Replies confidential.

P-1197, Chemical Engineering
230 W. 42 St., New York 18, N. Y.

SOLVENT RECOVERY ENGINEER

A large and growing manufacturer of fine chemicals needs a chemical engineer with experience in the operation of solvent recovery equipment. Position vacancy is in its Eastern Pennsylvania Plant. Many opportunities for advancement in the organization. Qualified applicants please write.

P-1253, Chemical Engineering
230 W. 42 St., New York 18, N. Y.

CHEMICAL ENGINEER

To Do Process Design Work For Large N. Y. Refinery Contractor. Preferably 1 To 3 Yrs. Experience In Process Design Of Petroleum Refining Equipment.

State age, education, experience in detail & salary expected.

P-1078, Chemical Engineering
230 W. 42 St., New York 18, N. Y.

**PLANT & MAINTENANCE
ENGINEER**

Experienced, for work in Continental United States. Some traveling necessary. State salary expected, age, experience, and date available for work.

Write box CE 294,
221 W. 41 St., New York 18, N. Y.

CHEMICAL ENGINEER

with minimum four years experience in heavy chemical development and plant layout. Good opportunity for right man with growing organization. Chicago area.

P-1667, Chemical Engineering
230 W. 42 St., New York 18, N. Y.

When Answering BOX NUMBERS...

to expedite the handling of your correspondence and avoid confusion, please do not address a single reply to more than one individual box number. Be sure to address separate replies for each advertisement.

ENGINEERS DESIGNERS & CHECKERS DRAFTSMEN

PIPING REINFORCED CONCRETE
HEAT TRANSFER PRESSURE VESSELS
INSTRUMENTATION STRUCTURAL STEEL
MECHANICAL EQUIPMENT

WHAT KELLOGG'S 50th ANNIVERSARY MEANS TO YOU

Our prompt recognition of individual achievement on our engineering staff means more opportunities for you in professional development and financial reward. This policy has been largely responsible for Kellogg's leadership in the field, after 50 successful years designing and developing oil refineries and chemical plants throughout the world. Applications mailed on request.

Write, Phone or Visit

The M. W. Kellogg Co.

225 Broadway, New York 7, N. Y. Room 1302
Telephone WOrth 4-3900, Extension 120 or 121
Saturdays by appointment.

ENGINEERS ELECTRICAL - MECHANICAL - STRUCTURAL

Openings in Ohio and New York offices offering long term employment with good salary for qualified Group Leaders, Designers and Draftsmen experienced in one or more of the following phases of industrial plant design:

- Electrical** Power, lighting layouts and electrical controls.
- Mechanical** Plant layout, process piping, conveyors, heating and ventilation, boiler houses, process equipment layout, refrigeration, plumbing, tanks and vessels, packaging equipment, special machinery and equipment.
- Structural** Structural steel and reinforced concrete.

Please submit complete resume stating experience, education, salary required and availability date.

THE H. K. FERGUSON COMPANY Engineers and Builders

The Ferguson Bldg. 1783 E. 11th St.
Cleveland 14, Ohio

19 Rector Street
New York 6, N. Y.

WHY LOSE PRODUCTION

GOOD EQUIPMENT IMMEDIATELY AVAILABLE

AUTOCYLAVES

2,000 gal., steel, jack'd., 200 PSI (6).

BINS

16' x 20' str. side, 7' cone.
7'8" x 11'6" x 17'3" (2).
4' x 3' x 30' (2).
8' x 8' x 14' with 4' U bottom (2).

BLENDERS

Start. 8A, 157 cu. ft., steel (2—NEW).
Conical, copper, 20", 2.7 cu. ft.
Patterson, type B, rotary, conical.

BELT CONVEYORS (TROUGHING)

104 ft. canters 14" w/structural (2).
25 ft. canters 18" w/structural.
13 ft. canters 14" w/structural (1).

BUCKET ELEVATORS (STEEL ENCASED)

11' canters 4" x 6" buckets.
22' canters 4" x 6" buckets (4).
30' canters 4" x 6" buckets (4).
40' canters 4" x 6" buckets.
48' Webster 14" x 6" Buckets.
60' Jeffery 10" x 6" Buckets.

CENTRIFUGES

Bird, 36" x 50", cont. rubber covered, SS.
A.T.&M. 60" SS type 316.
Bird, 24", cont. type CM, series 200, steel.
Bird, 40" x 60", solid bowl, rubber lined.
Bird, 40", suspended, rubber lined.

DRYERS

Devine, vac. 11, shell, Cl, 170 sq. ft.
Burlakov, drum, 24" x 20", SS & aluminum.
Laboratory Spray, SS, 11.

FILTERS

Oliver, 8' x 10' 250 sq. ft., wood & steel (3).
Oliver, 6' x 6', 118 sq. ft., wood & steel.
Oliver, 11'6" x 14', 500 sq. ft., wood & steel.
No. 7 Sweetland, 41 taps, 2", 19 leaves.
No. 7 Sweetland, 41 taps, 2", 30 leaves.
No. 7 Sweetland, 20 taps, 4", 30 leaves.

FLAKERS

48" x 40", Burlakov, steel (2).

KETTLES

40 gal., SS clad jack'd., 40#, hinged covers.

→ ABOVE IS ONLY PARTIAL LISTING OF OUR INVENTORY ←

ASK FOR BROCHURE

Heat and Power Co., Inc.
70 PINE STREET NEW YORK 5, N. Y.

MACHINERY & EQUIPMENT MERCHANTS

KILNS, COOLERS, DRYERS

3' x 25' x 3/4" shell (2).
4' x 25' x 3/16" Struthers-Wells.
4' x 16' x 3/4" Iowa Mfg.
4' x 34' x 3/16" Struthers-Wells.
4'6" x 40' x 3/4" Traylor.
6' x 14' x 9/16" Struthers-Wells (2 NEW).
7'6" x 60' x 1/2" shell.
9' x 8' x 48' x 3/4" shell Traylor.

MILLS, PULVERIZERS & CRUSHERS

14" x 16" B&S 2-roll spiked (NEW).
16" x 40", three roll.
22" x 12", four cage.
Four cage, Stedman.
Size B, Abbe.
33 Williams.
38" x 24", Jeffery.

MIXERS

Ajax, 33 Super, 173 gals.
Champion, type E, size 2, 110 gals.
Binks, type TM60, 100 gals. (2).
Blystone, 48" x 6'7", 300 gals. (2).
Rendco, 1 1/2 SA, 88 gals.
Paddle, double shaft, 1,050 gals. (NEW).
Alpha, double screw, 240 cu. ft. (NEW).

PRESSURE VESSELS

3,300 gal., 3' x 24' x 3/4", 200 PSI riv. (5).
3,700 gal. 3' x 25' x 1/4", 20 PSI, weld.
8,200 gal., 6' x 40' x 2", 390 PSI riv (2).
10,500 gal. 9' x 23' x 3/4" 150 PSI.
16,000 gal., 8' x 45' x 1/4" 150 PSI ASME.
25,000 gal., 10' x 40' x 1—7/16", 290 PSI ASME.

PROPANE AUXILIARIES

Gasair Propane Mixers & Vaporizers (3).
Bruner LPG-3 Compressor

STORAGE TANKS

350 gal., 3' x 6'8" x 1/4".
1,400 gal., 8' x 7' x 3/16" cone bottom (2).
2,100 gal., 9' x 6'6" x 3/16" cone bottom (2).
3,000 gal., 3' x 21' x 1/4", type 430 SS.
9,600 gal., 11' x 13'9" x 3/4" (NEW).
13,500 gal., 10' x 21'6" x 1".
15,300 gal., 9' x 32' x 3/16".
16,200 gal., 10'6" x 23' x 1/4".

TANK CAR TANKS

6,500 gal., 76" x 27'10" Extra Heavy (30).

TOWERS

26" x 11', Havg.
24" x 94", rubber lined.
20" x 63", steel.
3' x 43' steel Bubble Cap.
6' x 44', scrubber, steel.

STAINLESS STEEL TOWERS

72" x 29'8", Bubble Cap.

FOR SALE

4—Eimco Thickeners—40' x 10'
50' x 10'

VERY GOOD CONDITION

3—40' x 10' and one 50' x 10'
Thickeners, steel tanks, truss
type superstructures, heavy
duty rakes, 3 H.P. Gearmotors,
220/440 volt.

OTHER THICKENERS IN STOCK

2—20' x 10' Denver low head,
bolted steel tanks
2—40' x 10' Denver low head,
welded steel tanks
1—45' 12' Dorr low head, welded
tank

— All with gearmotors 220/440 volt —

WRITE FOR DETAILS AND
COMPLETE LISTINGS TO

**ROGER PIERCE
EQUIPMENT SALES CO.**
808 Newhouse Building
Salt Lake City, Utah

STEEL STORAGE TANKS

6—80,000 bbl. 117' x 41' 10"
6—55,000 bbl. 114'6" x 30' 5"
3—37,500 bbl. 95'5 1/2" x 30'4 1/2"
3—25,000 bbl. 78' x 29'4"

All steel cone roof, suitable re-erection. Tanks
standing location Texas Co's former refinery,
West Dallas, Texas. Full particulars furnished
on request.

**Rogers & Wright,
Inc.**
Wright Bldg.
Tulsa, Oklahoma
Ph. 3-3229

**Mid-States Pipe
& Supply Co.**
Box 2534
Tulsa, Oklahoma
Ph. 2-9128

FOR SALE

5000 gal. S.S. Truck Tanks & Trailers.
S.S. Heat Exchangers, Plate & Surface Type.
100 gal. S.S. Cold Jkt. Refrign. 30" x 32".
100 to 300 gal. S.S. Mix Tanks, water jkt.
500 gal. S.S. Mix Tank, 71" x 30".
500 gal. Copper Tank, 42" x 36".
300 gal. Phosphor Holic Glass Lined Tank, 25".
Day Vibrating Screen, 40" x 64", 1 H.P.
24" dia. to 42" x 120" Double Drum Dryers.
4-50 gal. Steel Kettles, 72" dia. A.S.M.E.
Premier Colloid Mill 5 1/2 H.P. motor.
Manual 10H Mikro Pulverizer, 5 H.P.
75 to 1000 gal. Homogenizers or Vincologers.
60P Centrifugal Extractors, s.s. baskets & curbs.
Model 1400 Stokes High Vacuum Pump, 1 1/2 H.P.
Size S-3 Lohman Van. Pump, 12.7 C.F.M.
1 1/2" and 2" S.S. Centrifugal Pumps.

Send us your inquiries

LESTER KEMOCH MACHINERY CORP.
1 East 42nd Street, New York 17, N. Y.
Murray Hill 2-4610

"CONSOLIDATED"

MEANS
DELIVERIES
AND
PRODUCTION
NOT
DELAYS AND PROMISES



SERVING INDUSTRY FOR 35 YEARS—BUY WITH CONFIDENCE

FILTERS & FILTER PRESSES

- 1—8' x 12' ALL STAINLESS STEEL Fine Rotary Continuous Vacuum Filter, string discharge, with blankets and STAINLESS STEEL trough, rasppulper, receivers, vacuum pump, motors, reducers, etc. ETAO ±387.
- 1—Sparkler Filter 18-5-12 STAINLESS STEEL.
- 1—8' x 12' Oliver Load-Wood Vacuum Filter, Acid-Resisting.
- 3—Oliver Vacuum Filters, Incl. 8' x 12', 11'6" x 14', 11'6" x 18'.
- 2—ALUMINUM Sperry FILTER PRESSES: 1—30" x 30"; 1—24" x 24", Plate and Frame, 45 chambers.
- 1—±12 Sweetland Filter, 36 leaves on 4" centers.
- 1—Kilby 39x39 CI Filter Press, open delivery.

CRYSTALLIZERS OR RIBBON MIXERS

- 4—Swenson-Walker Jacketed Crystallizers in 10' sections, (1—70' in. and 3—80' in. each with pulley driven gear reducer and 10 H.P. A.C. motor). Units are 24" I. D. x 26" high with 3/4" thick steel plate and 1/4" steel jackets, steel covers and ribbon agitators.
- 6—400 ±, 2000 ± Cap ribbon mixers.

DRYERS

- 1—70" x 40' STAINLESS STEEL Ruggles-Coles Rotary Dryer.
- 1—4' x 30' STAINLESS STEEL lined Louisville Rotary Dryer with reducer and 10 H.P. motor.
- 2—Bufflovak Double Drum Dryers 32" x 90" complete.
- 1—Vacuum Shelf Dryer, 8 shelves 42" x 42".
- 1—5' x 53' Harding Co. D. H. Rotary Dryer or Cooler.
- 1—6' x 30' Louisville welded shell Rotary Steam Tube Dryer with two rows, 34 tubes. Also two 6' x 27' Davenport, same type.

STAINLESS STEEL CENTRIFUGALS

- 3—43" All Stainless Steel Centrifugals, Amer. T&M Co., each with 5/8 basket, curb, casing, shaft, unloader, and 40 H.P. variable speed Slip Ring 3/40/440 V. 1200 RPM motor with full controls. Suspended bottom discharge type. Now at Newark.

RAYMOND PULVERIZERS

- 2—3-roll Raymond High Side Pulverizers, including separators, exhausters, cyclones, tubular collectors and inter-connecting piping.

CONTINUOUS CENTRIFUGALS

- 1—18 x 28" Bird Continuous Solid Bowl Centrifugal, STAINLESS STEEL Bowl, bronze cover. Also 24" x 38" centrifugal with solid stainless steel tapered bowl, other parts of monel.
- 1—36 x 48" Bird-Laughlin Continuous Centrifugal Filter, STAINLESS STEEL horizontal basket, 25 H.P. motor.

JACKETED KETTLES

- 63—Aluminum and Stainless Steel. 20 gal. to 130 gal.
- 2—1000 steel, closed.
- 1—5000 gal. steel, closed, agitated.

MISCELLANEOUS

- 1—Copper Rectifying Column, 6 sections, 30" dia. x 33' high, bubble cap type.
- 6—Ross 20 gal. heavy duty Pony Mixers.
- 1—1800 gal. open top, jacketed, Stainless Steel Tank.
- 1—Abbe 175 gal. Buhrstone-Lined Pebble Mill.
- 15—Dry Powder Mixers and Blenders, rotary and horizontal ribbon type, 100 to 5000 lb.
- 1—Pneumatic Scale Automatic Packaging unit, including Tight Wrap, 32 per minute.

CASH FOR IDLE MACHINERY—SEND US YOUR LIST TODAY

CONSOLIDATED **PRODUCTS**
COMPANY, INC.
15 PARK ROW, NEW YORK 38, N. Y. **BARclay 7-0600**

SETTING PRETTY...

YES—YOU'RE "SITTING
PRETTY" WITH

GELB MACHINERY FOR REAL VALUE



THE GELB GIRL JULY, 1951

- 1—Sparkler Stainless Steel Jacketed Filter, Model #33512.
- 1—Sparkler Stainless Steel Jacketed Filter, Model #33D7.
- 1—Niagara Stainless Steel Filter, 146 sq. ft.
- 2—Shriver 12" x 12" Stainless Steel Plate & Frame Filter Press, 14 Chambers.
- 2—Sperry Rubber Covered Plate & Frame Filter Presses, 24" x 24" Open Delivery, 14 Chambers.
- 2—Stainless Steel Jacketed Vacuum Kettles, 250 gal. cap.
- 1—Stainless Steel Oil Fired Kettle, 1000 gal. cap.
- 1—Nickel Jacketed Kettle, 400 gal. cap.
- 1—Nickel Jacketed Vacuum Kettle, 10 gal. cap.

- 1—Tolhurst Stainless Steel Suspended type Centrifuge, 40" Imperforated Basket.
- 10—Sharples Super Pressurite Centrifuges #6.
- 1—Sharples Super Pressurite Centrifuge, Stainless Steel Bowl, Model #16Y.
- 1—Jacketed Vacuum Autoclave, 800 gal. cap. with Agitator.
- 1—Blaw-Knox Jacketed Autoclave 3' x 4' 2" with Agitator.
- 1—High Pressure Steel Autoclave, 800 psi, 3' x 4' with Agitator and Motor Reducer.
- 2—Blaw-Knox Jacketed Autoclaves with Agitators, 300 and 500 gal. cap.
- 1—Genco Copper Conical Blender, 3½ cu. ft.
- 1—Kawano 125 H. P. Boiler, 125 lbs. pressure.
- 2—Builovak Vacuum Shell Dryers, 7. & 17 Shelves.
- 2—Black & Clawson Double Drum Dryers 28" x 5'.
- 2—Louisville Rotary Steam Tube Dryers, 6' x 30".
- 2—Builovak Vacuum Drum Dryers, 24" x 30".
- 2—Builovak Vacuum Drum Dryers, 5'10" x 10".
- 3—Louisville Rotary Steam Tube Dryers, 6' x 25".
- 1—Builovak Double Drum Dryer, 32" x 90".
- 1—Builovak Double Drum Dryer, 24" x 36".
- 1—Fitspatrick Stainless Steel & Bronze Model D Commutating Machine.
- 3—Builovak Flakers 3' x 12".
- 1—Ruggles Cole Direct Fired Kiln 7½' x 60".

- 1—Royal #21 Perforated Extruder, with heating unit.
- 1—American Locomotive Stainless Steel Heat Exchanger, Model Twin Double Pipe, Size 3½ x 27 x 34.
- 4—Steel Heat Exchangers, 800 sq. ft. each.
- 1—Sperry 36" x 36" Recessed Type Filter, centre-load, open-delivery, 42 Herosite covered Plates.
- 3—Valles Filters, #2E, 2B & 3.
- 10—Alcop Bronze & Brass Filters, Model #PAK 13-4.
- 1—Sperry Aluminium Filter Press, 16" x 18", 8 Chambers.

- 2—Stainless Steel Open Top Jacketed Kettles, 50 & 300 gal. cap.
- 1—Stainless Steel Jacketed Vacuum Kettle with agitator, 250 gal. cap.
- 1—Stainless Steel High Pressure Kettle, 360 gal. cap.
- 2—Patterson Jacketed Vacuum Autoclaves, 4' x 10' with Drives and Motors.
- 1—Stainless Steel Jacketed Reactor, 550 gal. cap. with Stainless Steel Condenser & Stainless Steel Packed Column.

- 1—Sperry 42" x 42" Wooden Plate & Frame Filter Press, Closed Delivery, 54 Chambers with hydraulic closing device.
- 1—Shriver Cast Iron Jacketed Plate & Frame Filter Press, 36" x 36", 48 Chambers.

- 2—Shriver Cast Iron Filter Press, 36" x 36", Closed Delivery, 33 & 36 Chambers.
- 1—Sperry Cast Iron 30" x 30" Filter Press, Recessed Type, 33 Chambers, Open Delivery.
- 2—Sperry Tin Plated 18" x 18" Plate & Frame Filter Presses, Closed Delivery, 20 Chambers.
- 1—Copper Jacketed Kettle, 6' x 8' with agitator.
- 6—Cast Iron Jacketed Kettles, 210 to 600 gal. cap.
- 1—J. P. Devine Vacuum Jacketed Kettle, 2000 gal. cap.
- 9—Steel Electrically Heated Kettles, 450, 900 & 1000 gal. cap.
- 18—Pondler Jacketed Glass-Lined Kettles, 360, 450, & 1750 gal. cap.
- 1—Banbury Mixer #1 with 30 Hp motor.
- 3—Baker Perkins Double Arm Mixers, 200 gal. cap., sigma blades.
- 2—J. H. Day Mogul Type Mixers, 2½ & 3 gal. cap.
- 3—Simpson #30 Intensive Mixers, "Unused".
- 1—Simpson #31 Mixer.
- 1—Day Poney Mixer, 15 gal. cap.
- 1—Patterson Porcelain Lined Pebble Mill, Type D, with 25 HP motor.
- 3—Hardinge Conical Ball Mills, 6' x 30", 5' x 23" and 6' x 23".
- 1—Abbe Engineering Silica-Lined Pebble Mill, 6' x 12".
- 1—Abbe Engineering Bauxite-Lined Ball Mill, 5' x 4".
- 1—Ball Mill, Stone-Lined, 7' x 9".
- 2—Mikro Pulverizers #1 SH.
- 1—Mikro Stainless Steel Pulverizer #3 TH.
- 1—Pondler Glass-Lined Jacketed Reactor, 1,700 gal. cap.
- 5—Rubber-Lined Storage Tanks, 300 & 250 gal. cap.
- 3—Stainless Steel Storage Tanks 50, 100, & 221 gal. cap.
- 5—Copper Mixing Tanks, 3, 100 gal. cap.
- 3—Steel Storage Tanks, 10,000 gal. cap.
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- 2—Orville Simpson #41, Rotor Screens.

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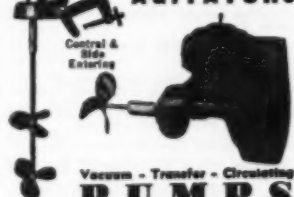
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- 2-Sweetland 212 with 72 S.S. leaves.
- 1-Sweetland 212 with 20 leaves.
- 1-Sweetland 22 steel, 17 leaves.
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- 1-Swenson Rotary 4'x5', steel drum.
- 4-Shriver 30"x30" Recessed, 55 chambers.
- 4-Shriver 30"x30" P&F, 30 chambers.
- 1-Sperry Aluminum 30"x30" P&F, 28 chambers, with hydraulic closure.
- 1-Sperry Aluminum 24"x24" P&F, 22 chambers.
- 1-Shriver 18"x18" P&F, 15 C.I. chambers.
- 2-Sperry Type 30"x30", recessed, 25 C.I. chambers.
- 2-Shriver 18"x12" Aluminum P&F, 12 chambers.
- 10-Shriver Skeletons, 18"x22".

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- 1-Raymond 245 Imp. Mill.
- 1-Patterson 8'x16' Mangonose Jacketed Ball Mill.
- 1-Abbe 5'x6' Mangonose Jacketed Ball Mill.
- 5-Abbe 5'x5', 4'x3'x3', 3'x3'x3', 2'x3'x3' Pebble Mills.
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- 2-Hardinge Mills 8'x22", 4 1/2'x16".
- 3-Day 16"x40", 12"x30", 9"x24", 3-Ball Mills.
- 3-Raymond F, 8" and 4" Air Separators.
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- 1-Bell & Jewell 21 1/2' Rotary Cutter.
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- 1-Rotex Screen, 80"x120".
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- 6-Tyler Nummer 3'x5'.

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- 4-300 gal. steel, jacketed, agitated kettles.
- 6-2000 gal. steel jacketed agitated Kettles, 200 psi.
- 10-Stainless 20 to 500 gal. jacketed.
- 1-3200 gal. Horizontal rubber-lined Tank.
- 2-Buflavak 8' dia. Crystallizers.
- 2-300 gal. glass-lined 1/2 kld. Agitated Kettles.
- 1-Patterson 150 gal. 1/2 kld. Autoclave, 300# pressure.
- 1-Buflavak 300 gal. 1/2 kld. steel Impregnating Kettle.
- 2-Day 500 gal. steel, jacketed, agitated Kettles.

SPECIAL OFFERINGS

- 3-Baker Perkins 100 gal. Type JNM Double Arm Jacketed Mixers.
- 2-Pfaudler 2000 gal. glass-lined agitated Tanks with 10 HP motors.
- 2-6' dia. x 30' high S.S. Bubble Cap Columns.
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- 2-11'6"x18' Oliver Rotary Vac. Filters.
- 1-12500 gal. Hor. 10'x21'6"x1" Pressure Tank.
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- 1-3200 gal. Hor. Steel Pressure Tank, 70"x40'x2" for 390 psi.
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- 1-Baker Perkins 2 gal. S.S. Double Arm.
- 1-Howes 2000# Horis. Powder Mixer.
- 18-Day, Robinson 180# to 2000# Powder.
- 25-Electric Portable Agitators 1/4 HP to 5 HP.
- 3-Ross, Porter 40 and 50 gal. Pony Mixers.
- 9-Day Wall Mixers, 150 gal.

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- 2-Oliver 8'x10' monel Rotary Vacuum Filters with monel valves, rubber-covered trough, agitator & repulper, complete with receivers, drives & motors.
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- 1-Ruggles-Coles 4'x30' Indirect Heat Rotary Dryer.
- 4-Louisville Rotary Steam Tube Dryers 6'x50', 6'x35', 30"x20'.
- 1-Adi. 5'x35' Rotary Steam Tube Dryer.

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- 1-Stokes Vacuum Shell Dryer, 8 shelves, 45"x42".
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- 5-Atmospheric Double Drum Dryers, 42"x128", 32"x100", 32"x90", 30"x84".
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- 1-Milton Roy Proportioner Pump, S.S. and Hastelloy, 10 gpm.
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- 1-Colton Tablet Machine 25 1/2'.
- 2-Stokes Rotary Tablet Machines DD84, DD82.
- 1-21 Anderson Expeller.
- 2-Nash Hyter Vacuum Pumps to 400 cfm.
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 delivery, washing type, like new
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 3" 45" 6" 50 & 5" 170" Ball Mills
 30" 2" 30" Ball Mills, Tube Mills
 4—11½" 6" 16" Oliver Continuous Filters
 3—8" 4" Dorco Continuous Filters
 24" 24" Jeffery Hand Pumps
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- 4 VALLEZ Rotating Leaf Pressure Filters, type 49R3, 41 leaves 44½" OD on 3" centers, cast iron body, stainless steel covered leaves. Used only 6 months.

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- 8 Filter Presses, 12" to 36", C. 1.
- 2 Louisville 8-roll Continuous Grains Presses, 54" x 36" x 36".
- 1 Duvenport Rotary Grains Press, size 2A.
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- 2 Fan Dryers or Graining Kettles, 10' dia. x 8' deep and 5' dia. x 30' deep.
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- 2 Atm. Double Drum Dryers, 24" x 38".
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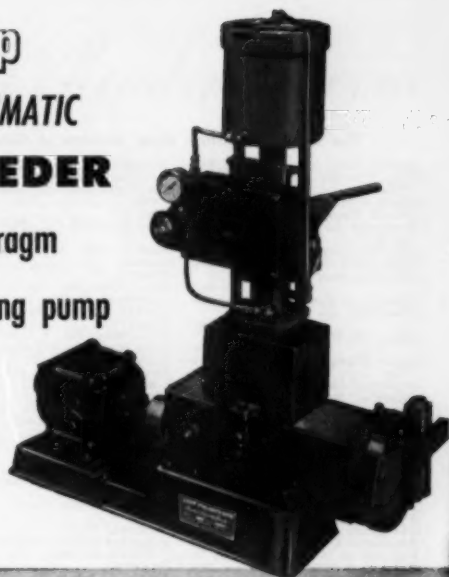
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For more data, circle item number on postcard.

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Stands, floor, for wheel operated	
valves	370c
Steel	223
Stickproof	15
Swing check	376a
3-Way No. 767	370d
"Y" reversible seat	376d
Vibrators, electric	B296
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pack, bulletin GRA-5571	163
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Chromic acid recovery system	65
Cyclotors	355
Demineralizer	281b
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Ion-exchange units	L356a
Ozonators	21b
Water analysis bulletin No. 11	345c
Water purifying system	281a
Water softeners & blenders	277
Wells & pumps	R384
Waxes, hydrogenated castor oil	223
Wire mesh	T211

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Reprints of last month's
Chemical Engineering Report

Designed Fire Protection

Application of fire prevention and fire control to the design of chemical processing plants is a highly specialized job. It is influenced by ever-changing process requirements and economics of the process involved. Insufficient experience sometimes makes proper evaluation of these considerations exceedingly difficult. However, certain practices are indicated as effective in the light of available experience.

Through planning in the drafting board stage, in maintenance, and in personnel education, fire safety can be enhanced. This is designed fire prevention.

Chemical Engineering's 10-page June Report discusses prevention and control of fire and their relationship to chemical plant design.

The report offers a nine-point program that will minimize fire damage and permit effective control and extinguishment.

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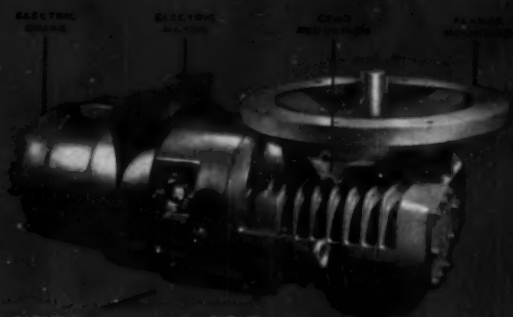
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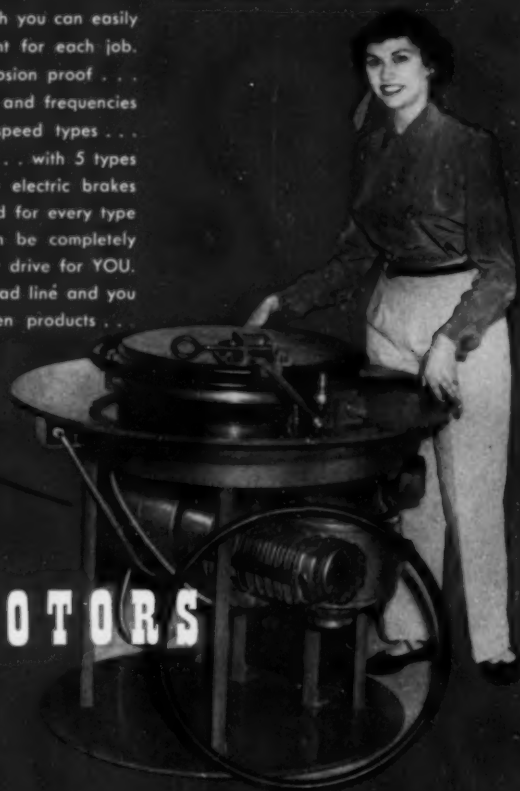


TABLE No. 1—RESISTIVITIES

TYPICAL SERVICE CONDITIONS		% by Wt.	PH VALUE	FANGLASS GLASS LININGS					OTHER MATERIALS											
				42	34	48	37	Nickel	Monel	Inconel	Aluminum	Copper	Duralc	Monelloy A, B, C, & D	Kalloy No. 2	Stavag	Lead	Rubber	304 Stainless Steel	316 Stainless Steel
HCl	Hydrochloric Acid	Conc. 33.47% 18" Be.	—	R*	R*	NR	NR	NR	NR	NR	NR	R†	R*	R	NR	—	NR	NR	NR	NR
HCl	Hydrochloric Acid	N 3.50%	0.1	R*	R*	NR	NR	R	NR	NR	NR	R†	R*	R	NR	R	NR	NR	NR	NR
HCl	Hydrochloric Acid	N/10 0.36%	1.0	R*	R*	NR	NR	R	R	NR	NR	R†	R*	R	NR	R	NR	NR	NR	NR
HCl	Hydrochloric Acid	N/100 0.036%	0.0	R*	R*	NR	NR	R	R	NR	NR	R†	R*	R	NR	R	NR	NR	NR	NR
H ₂ SO ₄	Sulphuric Acid	Conc. 77.67% 80" Be.	0.0	R*	R*	NR	NR	NR	NR	NR	NR	R†	R*	NR	R	—	NR	R	R	NR
H ₂ SO ₄	Sulphuric Acid	N 4.73%	0.3	R*	R*	NR	NR	R	R	NR	R	R†	R*	R	R	R	NR	R	R	NR
H ₂ SO ₄	Sulphuric Acid	N/10 0.46%	1.0	R*	R*	NR	NR	R	R	NR	R	R†	R*	R	R	R	R	R	R	R
H ₂ SO ₄	Sulphuric Acid	N/100 0.046%	0.1	R*	R*	NR	NR	R	R	NR	R	R†	R*	R	R	R	R	R	R	R
HNO ₃	Nitric Acid	Conc. 69.97% 90" Be.	0.03	R*	R*	NR	NR	NR	NR	NR	R	R†	R*	NR	NR	—	R*	R*	R*	R*
HNO ₃	Nitric Acid	N 6.36%	1.0	R*	R*	NR	NR	NR	NR	R	NR	R†	R*	NR	NR	NR	—	R*	R*	R*
HNO ₃	Nitric Acid	N/10 .60%	0.0	R*	R*	NR	NR	NR	NR	R	NR	R†	R*	NR	NR	NR	—	R*	R*	R*
H ₃ PO ₄	Phosphoric Acid	N 3.39%	0.0	R*	R*	R	NR	R	R	R	NR	R†	R*	R	R	R	—	—	—	—
H ₃ PO ₄	Phosphoric Acid	N/10 0.33%	1.5	R*	R*	R	NR	R	R	R	NR	R†	R*	R	R	R	—	—	—	—
CH ₃ COOH	Acetic Acid	N 5.06%	0.6	R*	R*	R	NR	R	R	R	R	R†	R*	R	NR	R	R*	R*	R*	R*
CH ₃ COOH	Acetic Acid	N/10 0.09%	0.0	R*	R*	R	R	R	R	R	R	R†	R*	R	NR	R	R*	R*	R*	R*
CH ₃ COOH	Acetic Acid	N/100 0.009%	0.0	R*	R*	R	R	R	R	R	R	R†	R*	R	NR	R	R*	R*	R*	R*
C ₄ H ₄ (OH) ₂ (COOH) ₂	Tartaric Acid	N/10 0.73%	0.6	R*	R*	R	R	R	R	R	R	R†	R*	R	NR	R	R*	R*	R*	R*
COOHCH ₂ CH(OH)COOH	Maleic Acid	N/10 0.07%	0.6	R*	R*	R	R	R	R	R	R	R†	R*	R	NR	R	R*	R*	R*	R*
C ₆ H ₄ (OH)(COOH) ₂ /O	Citric Acid	N/10 0.64%	0.6	R*	R*	R	R	R	R	R	R	R†	R*	R	NR	R	R*	R*	R*	R*
CH ₃ COOH/COOH	Lactic Acid	N/10 0.06%	0.4	R*	R*	R	R	R	R	R	R	R†	R*	R	NR	R	R*	R*	R*	R*
Co ₂	Chlorine Acid	NA.00%	—	R*	—	—	—	NR	NR	NR	NR	R†	R*	NR	NR	—	NR	NR	NR	NR
NaHCO ₃	Sod. Bicarbonate	N/10 0.84%	0.6	R	R	R	R	R	R	R	R	R†	R*	R	R	R	—	—	—	—
Na ₂ CO ₃	Sod. Carbonate	N/10 0.53%	11.0	R	R	R	R	R	R	R	R	R†	R*	R	R	R	—	—	—	—
NR ₂ OH	Am. Hydroxide	N/90 0.33%	11.1	R	R	R	R	R	R	R	R	R†	R*	R	R	R	—	—	—	—
NaOH	Sod. Hydroxide	N/10 0.46%	15.0	NR	NR	NR	NR	R*	R*	R*	NR	NR	NR	R	R	NR	R*	R*	R*	R*
KOH	Pot. Hydroxide	N/10 0.56%	15.0	NR	NR	NR	NR	R*	R*	R*	NR	NR	NR	R	R	NR	R*	R*	R*	R*
Na ₂ PO ₃ ·10H ₂ O	Triacid. Phosphate	N/10 1.87%	15.0	NR	NR	NR	NR	—	—	—	NR	NR	—	—	—	—	—	—	—	—

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640% to 650%
650% to 660%
660% to 670%
670% to 680%
680% to 690%
690% to 700%
700% to 710%
710% to 720%
720% to 730%
730% to 740%
740% to 750%
750% to 760%
760% to 770%
770% to 780

City _____ State _____